Table of Contents

Volume 28, Issue 1 • 2003

The *Journal of Vocational Education Research (JVER*) is published three times a year and is an official publication of the American Vocational Education Research Association *(AVERA)*. *AVERA* was organized in 1966 and strives to: (a) stimulate research and development activities related to vocational education, (b) stimulate the development of training programs designed to prepare persons for responsibilities in vocational education research, (c) foster a cooperative effort in research and development activities with the total program of vocational education, career and technical education, and other areas of education and other disciplines, and (d) facilitate the dissemination of research findings and diffusion of knowledge.

The Journal of Vocational Education Research

Editor	Joe W. Kotrlik, *Louisiana State University*
Managing Editor	Morgan Lewis, *The Ohio State University*
Publisher	American Vocational Education Research Association

EDITORIAL POLICY: The *Journal of Vocational Education Research* (*JVER*) publishes refereed articles that examine research and research-related topics in vocational education, career and technical education, preparation for work, and the workplace. The *JVER* Editorial Board is committed to publishing scholarly work that represents a variety of conceptual and methodological bases. Submission of manuscripts representing one of the following styles is encouraged: (a) empirically-based manuscripts that report results of original research, either quantitative or qualitative, (b) reviews or synthesis of empirical or theoretical literature, (c) essays derived from original historical or philosophical research, (d) reviews of recently published books, and (e) rejoinders to articles recently published in the *JVER*. Page costs are not typically assessed. However, if a manuscript is accepted, authors will be asked either to supply camera-ready tables and figures, or pay for the costs incurred in preparing complex tables and figures for publication.

Printed by The Ohio State University, Columbus, OH.

MANUSCRIPT PREPARATION Two (2) printed copies and 1 electronic copy (on floppy disk, CD, or e-mail) of the manuscript should be submitted to the Editor. The electronic version must be in MS Word version 6 or higher. Manuscripts typically range in length from 20 to 30 double-spaced pages including references, tables, and figures. Text, references, and tables must be prepared according to the guidelines detailed in the *Publication Manual of the American Psychological Association* (5th edition). The title page should include the title of the article, and the name, affiliation, mailing address, e-mail address (if applicable), and telephone number for each author. Each manuscript must be accompanied by an abstract of no more than 150 words. Receipt of all manuscripts will be acknowledged within one week of receipt. Manuscripts are subjected to a double-blind refereed review process. Typically, three individuals, plus the Editor, review each manuscript. Reviewers' comments and a letter indicating the publication decision will be sent to the primary author approximately 3-4 months following receipt. Manuscripts accepted for publication are usually published within one year of formal acceptance. To defray rising publication costs, authors who are not members of *AVERA* will be required to pay a $50.00 fee if their manuscript is accepted for publication. Published authors will receive two complimentary copies of the *JVER.*

Send manuscripts to:

Dr. Joe W. Kotrlik, Editor
School of Human Resource Educ. & Workforce Dvlp.
Louisiana State University, 129 Old Forestry Bldg.
Baton Rouge, LA 70803-5477

Phone: 225.578.5753
FAX: 225.578.5755
E-mail: kotrlik@lsu.edu

READER COMMENTS The *Journal* welcomes comments from readers on articles that have appeared in recent issues. Submitted comments must speak directly to content of the article of reference, not exceed four manuscripts pages, and conform to *APA* reporting format. These manuscripts may be sent out for peer review at the Editor's discretion. Author(s) of the original article will have an option of responding to published comments of their work.

SUBSCRIPTIONS The *JVER* is included in annual memberships dues to the American Vocational Education Research Association (*AVERA*). Journal subscriptions are $57 per calendar year to nonmembers. Subscribers outside the United States should add an additional $10 to cover mailing costs. Subscription orders and inquiries should be addressed to the Managing Editor.

This publication is available in microform. Call toll-free 800.521.3044 or mail inquiry to University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106.

Journal of Vocational Education Research, 28(1), p. 1-2.

Editor's Note

Joe W. Kotrlik
Louisiana State University

This issue is my first as Editor of the *Journal of Vocational Education Research* (*JVER*). Morgan Lewis continues to serve *JVER* as Managing Editor and has been very supportive in my transition. I especially want to thank outgoing *JVER* Editor Jay Rojewski, AVERA President Ted Lewis, the members of the *JVER* Editorial Board and all of the reviewers for their advice, service, and support. Your willingness to provide information has made my job much easier.

Four manuscripts are published in this issue. In his Presidential Address, Jay Rojewski addresses the globalization and internationalization of research on career and technical education. He offers his perspective concerning the role of international research for an organization dedicated to the investigation of career, vocational, and technical education in all forms and contexts, the American Vocational Education Research Association (AVERA). He concludes with several recommendations, including a possible name change for AVERA, the appointment of a committee to chart the future directions of AVERA on the issue of international research, and the need to plan and implement collaboration with IVETA. Given the ongoing changes in vocational, career, and technical education in the U.S. and the implications of changes in the Perkins Act, AVERA members should read and give serious consideration to his points of view.

The study by Dennis Field addresses high school students' applied technology proficiency as a result of participating in applied and traditional courses. Using the Work Keys Applied Technology Test and hierarchical linear models, this study compared the applied technology skills levels of high school students enrolled in various applied and comparable traditional courses. Field concluded that performance is comparable for the two groups of students when certain demographic variables are taken into account.

David Neumark and Ann Allen report case study research on the effects of school-to-work in Michigan. The goal was to see if an "exhaustive case study" of Michigan school-to-work initiatives could provide a more convincing picture of the positive effects of school-to-work programs than has been reported in other national studies. This paper provides a solid foundation for the need for future research on school-to-work programs.

Both the Field and Allen, and the Neumark studies report program evaluation research and complement Sheila Ruhland's review and synthesis of state and local Tech Prep evaluation efforts. Ruhland recommends a management-oriented evaluation guide those responsible for the planning, data collection, and analysis of Tech Prep program and student outcomes data.

The article by Eisenman, Hill, Bailey, and Dickison describes their assessment of a university-based institute on integrated academic/occupational learning and complements the other studies reported in this issue. An analysis of teachers' discussions, interviews, written products, and classroom observations were used to trace the transformation of teachers' thinking about the purpose of integrating academic and occupational curricula as they experienced other workplace cultures and implemented collaborative projects in their schools.

All of these papers provide focus to the need for high quality program evaluation research in vocational, career, and technical education. The research reported answers some of our questions about quality programs and also provides an excellent foundation for future research.

jwk

Journal of Vocational Education Research, 28(1), pp. 3-13.

Globalization and the Internationalization of Research on Career and Technical Education[1]

Jay W. Rojewski
University of Georgia

Abstract

I offer my perspective concerning the role of international research for an organization dedicated to the investigation of career, vocational, and technical education in all forms and contexts, to the American Vocational Education Research Association (AVERA). While I do represent AVERA, the views outlined here are not AVERA policy nor do they necessarily represent official positions of the organization. With that said however, I believe that they are to some degree reflective of AVERA members' views and reflect the broader arena of technical and vocational education research conducted in the U.S.

Mission and Activities of AVERA

AVERA was organized in 1966 as a professional association for scholars, most residing at four-year colleges and universities, interested in the investigation of education on work, family, and community. The world was a very different place when AVERA arrived on the scene in the mid–1960s. The high-tech, high-skill, fast-paced world we know today was still in an embryonic stage. Instead, the world was characterized by the daunting specter and pervasive influence of the Cold War and " . . . the clash between communism and capitalism, as well as detent, nonalignment, and perestroika" (Friedman, 1999, p. 7). In terms of the labor market and economies of the world, " . . . less developed countries would focus on nurturing their own national industries, developing countries on export-led growth, communist countries on autarky and Western economies on regulated trade . . . " (p. 7). Most businesses and economies, whether national or international, moved slowly and deliberately. A lot of workers performed tasks that were routine and required minimal technical skills and little, if any, cognitive ability. Vocational education focused primarily on the development of manual and technical skills required to be successful in this type of environment. From a mid–1960s worldview, the notion of international research and collaboration was really not a critical concern. And, if undertaken by individual scholars, the purpose of international research was, more than likely, represented by a one-way exchange where scholars viewed themselves as representing a superior culture. Often, many of those involved with international research efforts saw their role as helping less developed countries become more advanced and "just like us."

As originally established, AVERA upheld four primary purposes: (a) to stimulate research and development activities related to vocational and technical education, (b) to develop training programs designed to prepare persons for responsibilities in vocational and technical education research, (c) to foster a cooperative effort in research and development activities with the total program of vocational and technical education, other areas of education, and other disciplines, and (d) to facilitate the dissemination of research findings and knowledge (AVERA, 2001). Perhaps the most important function of AVERA is to provide its membership with current and emerging information about new developments and ongoing trends and issues that affect vocational and technical education and research. Traditionally, the focus of such information has been national in scope. Here, I consider whether this scope should be expanded to formally acknowledge and encompass international issues as well.

A primary method used by AVERA to accomplish its purposes is through participation in several national conferences (e.g., Association for Career and Technical Education, American Educational Research Association) where research is presented annually and individuals have opportunities to meet and interact with others who share similar professional interests and concerns. The organization also sponsors one of the primary publication outlets in the U.S. for scholarly dissemination efforts in vocational and technical education, the *Journal of Vocational Education Research* (JVER). Historically, the JVER has published a wide assortment of manuscripts reflecting qualitative and quantitative orientations and has not been limited by content or discipline area, population, or geographical context.

International Nature of AVERA

AVERA does not have an official international focus, although some individual members are from other countries or pursue international research interests as part of their scholarship. Despite individual (and perhaps even institutional) interests, an international focus has not clearly emerged within the organization. For example, in a recent three-year period (1997–1999), the JVER published only 3 of 54 articles that contained an international theme or were written by authors outside the U.S.[2, 3]

In 2000, then–President William G. Camp made a strong appeal to the AVERA membership to consider an international future for AVERA, "to think global." He raised several questions designed to engage the membership in discussion. Do we [AVERA] not have research to share in an international setting? Is AVERA just an American organization? Should it be? Is it time to expand our organizational horizons by looking outward rather than inward? Camp concluded, " . . . the organization should expand its vision to become an international organization . . ." (p. 2), but stopped short of making a formal proposal to that effect. He argued that submitting a formal proposal was beyond the purview " . . . of the President in an organization that changes its officers annually" (p. 1). To date, no formal proposal reflecting Camp's vision has been advanced from the general membership and it appears that " . . . in the absence of a formal proposal . . . we will simply continue to discuss 'what-ifs' and never take action" (p. 2).

An Understanding and Rationale for Internationalization

I believe that AVERA needs to incorporate and nurture a clear, articulated emphasis on international issues relevant to career and technical education. Given the nature of the emergent workforce throughout the world and the international nature of work and national economies, it appears not only prudent but imperative that this initiative be made. Recently, Stead and Harrington (2000) bluntly stated, "To assume that all of a country's work-related problems can be solved independently is shortsighted and provincial" (¶ 1). Therefore, this section provides a rudimentary rationale for why AVERA should adopt an international perspective.

It is clear that the issue of globalization serves as a primary catalyst for career and technical educators in the U.S. and worldwide adopting an international focus in research and educational programs (Doherty, 1998; Hobart, 1999; Zeszotarski, 2001). Friedman (1999) explained that

> globalization is not just some economic fad, and it is not just a passing trend. It is an international system—the dominant international system that replaced the Cold War system after the fall of the Berlin Wall. We need to understand it as such . . . . It also ha[s] one overarching feature—integration. The world has become an increasingly interwoven place, and today, whether you are a company or a country, your threats and opportunities increasingly derive from who you are connected to. (pp. 7-8)

Globalization, or internationalization, then, refers to our growing reliance on a worldwide market and an increasing interdependence of the world's economies on that market, as well as the diminished national autonomy that results. Trends toward globalization, market deregulation, the worldwide influence of capitalism, and the need for knowledgeable workers skilled in information technology have broad economic, social, and cultural implications that are reshaping entire segments of the U.S. and other economies. Additional issues requiring an international focus on career and technical education include the growth of a mobile, global labor surplus poised to compete for jobs anywhere in the world, and the restructuring, merging, and downsizing of many work organizations resulting in a contingent workforce around the world that no longer enjoys job security, long-time institutional identification, or health and pension benefits (Herr, 2000). These trends increasingly require businesses (and nations) to attain standards " . . . that will enable them to succeed in the arena of global competition. These standards of best practice are therefore influencing the production, management, and employment decisions and practices of both national and international production and services entities" (Hobart, 1999).

> These problems and issues are no longer matters of concern to only one nation or one population . . . . As nations become increasingly interdependent, career problems transcend political boundaries, affecting entire regions of the world, not simply sovereign states. Thus, the solutions to career problems often require cross-national collaboration just as they require cross-professional organization collaboration. As a result, there needs to be constant cooperation between professional organizations and governments. (Herr, 2000)

Possibilities for Research on International Aspects of Career and Technical Education

It seems that the jury is still out on determining the ultimate benefits or drawbacks to an international focus for research in vocational and technical education (Hobart, 1999). Even so, given its position as one of several national research organizations in the United States focused on career and technical education, AVERA must be an active participant in the debate about the role of international research on vocational and technical education.

What are the benefits and potential drawbacks? Freeland (2000) identified some of the positive aspects of assuming a broad, more international mission and scope in career and technical education research. These include

1. Better understanding of costs and benefits associated with educational reform and reform in career and technical education in particular.

2. Comparative data can be used to shape national and regional educational policy.

3. Improvements can be gained pertaining to the assessment of program and training system effectiveness.

4. Comparative international data could help professionals determine the levels and types of training and education provided by different countries. This information could help determine the extent that students and workers are being prepared in the U.S. for elsewhere.

5. Investigations of curriculum could be used to identify demanding or inadequate offerings.

6. Outcomes for participants in secondary-based programs (or their equivalent) would provide a basis for determining whether graduation requirements are stringent or comparable to other countries.

A major problem with international research is that social and economic environmental influences cannot usually be transferred from one nation to another. This leaves the applicability of individual research studies somewhat in doubt and dependent on the particular circumstances associated with the investigation. Other potential barriers to effective international research efforts include language, social, cultural, and work-related differences. Sellin and Grollmann (1999) noted that even the definitions used by various countries to understand and articulate the essence of vocational training and research, and hence vocational training research, vary.[4]

Yet, despite such difficulties, Freeland (2000) asserts that international research in career and technical education and training is vital because the results of such work can (a) aid in identifying trends or changes in the status of vocational and technical education [in the U.S.], (b) shed a critical light on "taken for granted" assumptions about how vocational and technical education operates, and (c) suggest alternative methods and approaches. Further, when considering the limited international experiences of most U.S. educators, international research and personnel exchange as well as ongoing dialogue could be one way to acquire and understand issues from other parts of the world.

At the dawn of the 21st century, members of AVERA must develop and actively support the internationalization of the association. The universality of knowledge in the information age and the competitive nature of world trade dictate that AVERA broaden its range of vision. Internationalization affects most aspects of our lives particularly in areas related to work preparation, public education, trade, and maintaining an acceptable standard of living. It is no longer an abstract idea for our leisurely consideration; it is a reality and necessity.

Where are we now? In terms of national research agendas, Wonacott (2000) indicates that differences currently exist in the focus of research conducted in the U.S. and elsewhere.

> Recurring themes in the United States reflect change–what skills workers need for the changing workplace and how vocational education should provide them . . . . In Europe and Australia, attention is focused more on the impact of research on policy, decision making, and return on investment. (¶ 2)

Given these differences Wonacott asks,

> Why do comprehensive research programs in the U.S., Europe, and Australia have different emphases? Does the somewhat different focus and schedule of occupation-related research merely reflect the different priorities–and place–in the pipeline-of-front-line practitioners? Why do different themes recur in the U.S., Europe, and Australia? (¶ 5)

What might an emphasis on international research look like? One possibility is that AVERA develop and maintain a wide range of academic and professional activities, organizational policies, procedures, and strategies designed to integrate an international dimension or perspective into the association (adapted from Simon Fraser University, 1999). I identify five possible research agenda emphases that reflect an international focus as examples and for establishing a starting point for discussion and elaboration.

1. *Comparative studies*. International comparative studies are most often used to describe and explore progress made by countries toward the realization of national vocational and technical education and training goals, in respect to more developed countries. The results of such investigations are usually used for policy-based decision-making related to education and training programs. Freeland (2000) writes, “Perhaps the most significant way in which international comparative studies can assist policy-makers is in developing or uncovering an understanding of the network of factors that underlie particular outcomes in particular countries” (p. 4).

2. *Education and training activities: A look at best practices.* Speaking at the Second International Congress on Technical and Vocational Education, Timo Lankinen (1999), Director of Vocational Education and Training in Finland, remarked, “Although the ways of implementing vocational education and training are largely culture-dependent, we can also learn form each others’ methods and manners” (¶ 1). He posited challenging questions that could guide both national and international research.

> How to keep up vocational education and training with continuous changes and meet the requirements of the society and the world of work? How to make vocational education and training attractive to youth? Which is the best way to ensure youth a smooth transition from training to working life? How to create a system providing everyone the opportunity for individual continuing education and lifelong learning? How extensively should the mastery of professional skills, general education, and so-called generic skills be combined, or, on the other hand, kept separate? How to divide costs and labor between the educational system and the world of work most efficiently? (¶ 6)

At the same conference, Schmidt (1999) spoke about the pivotal role that education plays in the emerging “knowledge management and information age.” He argued that vocational education and training programs must place a greater emphasis on providing students with reasons for ongoing global changes and their impact on local work and workers, skills on how to gather, select, and use information and knowledge in the planning and decision-making process, problem-solving and practical skills, social and team skills, entrepreneurial skills, and the development of workers’ personality. All of these areas have some parallel in research focused on U.S. students and programs that could be expanded to a global scale.

3. *Problems, issues, and trends: Problems abound on the international stage*. U.S. researchers in career and technical education could examine both common and unique problems in any number of iterations. For example, economists and others are divided on whether the fallout of globalization is positive or negative. Some point to increased competition spurred by access to worldwide markets and the resulting benefits to consumers in the form of lower prices and more choice. Opponents predict an erosion of workers’ rights, particularly in developing countries and the loss of jobs in more industrialized nations as work is exported to countries with

cheaper labor and production costs. Other issues might include looking at ways that advancing technology influences employment preparation and attainment patterns, wage structures, or standards of living.

4. *Social justice*. A number of concerns have emerged on the international scene over the past several years that might be considered by international career and technical investigators. The unrelenting exploitation of women and child labor in lesser-developed countries, often by multi-national conglomerates seeking the lowest production costs, continues to be an issue. High rates of unemployment, aggravated by social and economic ills of the working poor, are a problem in many countries throughout the world (International Labor Organization [ILO], 1997).

Criticism, sometimes violent, about the unabated consumerism generated by the internationalization of markets and economies and the resulting damage that a consumption-oriented economy inflicts on a finite set of world resources must be addressed. What role does national or international career and technical education play in these types of scenarios? Can educators and scholars alike, whether in the U.S. or other countries, simply ignore these very controversial political and human issues connected to the workforce?

5. *Expansion and applicability of traditional vocational and technical areas* to different cultural and political contexts including a need to examine ways to balance work and family life. Constant demands for quicker and more timely goods and services from a world-wide consumer-driven population increasingly requires more from workers, usually in terms of longer hours at work and/or taking work home thus blurring the distinctions between work and leisure time. The need for understanding this phenomenon and identifying ways to counteract this growing trend will take on increased importance in the years to come.

Summary

Whatever the specific topic, international research should be guided by several themes that are based on the firm belief that any efforts initiated by AVERA or its members do not assume a superior attitude where scholars are represented as rescuing lesser-developed countries. Based on the responses of participants at the 5th International Conference on Adult Education, international research and cooperation should not mean merely transfer of resources and technical know-how but rather mutual learning and sharing of experiences. It should also involve institutional and organizational development, reciprocal communication and all parties learning from the process of international cooperation. International cooperation needs to be viewed as a mutually beneficial exercise between parties, for the purposes of enhancing their capacities to pursue their educational [and research] goals. It should be a mutually empowering experience and include a wide variety of actors from the grassroots to the national and international level. (UNESCO, 1999, pp. 4-5)

Recommendations

So, what does AVERA do at this point in time? It is more critical than at any time in the history of the organization that we collectively and publicly engage in dialogue about the role of international research in AVERA, and that we establish an official position for the organization (voted on by the membership) within one year. While I do not represent the official position of AVERA, I think that there are several ideas and initiatives that, as an organization, we must consider. These activities include the following:

1. *Name change?* Past AVERA President, William G. Camp (2000) posited, “An organization’s name should capture the core of the organization’s meaning. It should concisely reflect what the organization is about” (p. 2). If members of AVERA determine that an international perspective is important, a change in the name of the organization will be required.

2. *Appoint a special committee* charged with making special recommendations to the AVERA executive board concerning future directions for the association on the issue of international research. This committee could be composed solely of AVERA members or could incorporate IVETA membership for their perspective.

3. *Plan for and implement ongoing collaboration with IVETA*. One possibility may be to appoint liaisons from each organization that serve on each other’s executive board to relay information and facilitate collaborative efforts between the two groups.

4. *Plan and conduct special conference sessions at major research conferences* (ACTE, AERA, IVETA) within the next several years on international aspects of vocational and technical education.

5. *Plan and publish one or more special issues of the JVER.* Another option in terms of publication is to support a joint publication effort with IVETA on the topic of international research in career, vocational, and technical education. There is some precedent for doing this type of thing. Recently, the National Career Development Association (NCDA) and the National Employment Counseling Association (NECA) collaborated on a joint issue of their respective journals—The *Career Development Quarterly* and the *Journal of Employment Counseling*—devoted to collaboration, partnership, policy, and practice in career development.

In his presidential address to the AVERA membership several years ago, Thomas (2000) asked, “Are we making the changes needed in the organization . . . [to remain] a viable force in vocational education and what are the changes we should make in the future?” (p. 4). Thomas’ question challenges us as we consider whether to pursue an official position on the internationalization of AVERA including research, affiliations, and organizational scope. To remain viable, the association must vigorously pursue an official position. The emergence of an international perspective could provide AVERA with resurgence in membership and an increase in the influence of both AVERA and IVETA. Clearly, there is work to be done and my thoughts and recommendations serve only to stimulate our thinking and discussion on this issue. The possibilities are exciting. We should move ahead.

To close, I offer the words of one AVERA member who responded to a general call for comments on the issue of the internationalization of AVERA.[5]

> As the political, geographical, and cultural boundaries of the world become more permeable, as communication becomes easier, as teaching and learning crosses international boundaries in real time, our research will have to cross international boundaries as well . . . . When we engage in collaborative activities with people facing problems in settings outside of our own, we become more cosmopolitan, more knowledgeable, more concerned, and more aware that what happens in other parts of the world impacts or has profound implications for what we do here.

Endnotes

1. An earlier version of this paper was presented at the AVERA–IVETA jointly-sponsored symposium, *Internationalization of Research on Technical and Vocational Education*, which was conducted during the 2001 annual meeting of the Association for Career and Technical Education, New Orleans, LA.

2. Two of the articles were “German experience in easing the transition from school to early careers” (Geiss & Schmidt, 1999), and “How women [from Australia] experience social support as mature adult learners in a vocational setting” (Williams, 1997).

3. A notable exception is the 2000 annual meeting of the Vocational Education SIG, American Educational Research Association (AERA). There, one-third of the scholarly presentations on vocational and technical education (5 out of 16) were international in terms of presenters and/or scope of papers. Unfortunately, not all of these papers have made their way to publication in the JVER.

4. Sellin and Grollman (1999) proposed the following definition as a working basis for describing research on international vocational and technical education and training:

> Vocational training research is the study, on the basis of scientific criteria and appropriate methodology, of personal and social conditions, of the processes involved in imparting and acquiring knowledge and skills and the outcome of those processes, and of attitudes and behaviour patterns which have a particular bearing on potential or actual roles in the economic and social division of labor. (p. 69)

5. I am indebted to a number of AVERA members who responded to an open-ended query I posted to the AVERA listserv on September 6, 2001. Their comments were helpful in clarifying the issue and developing my responses.

Acknowledgement

Special acknowledgement and thanks to William G. Camp for initially raising this issue during his term as AVERA President and for offering me the benefits of his thoughts and insight on the topic.

References

American Vocational Education Research Association (AVERA). (2001). *Description and history of AVERA. Who joins AVERA?* Retrieved on September 5, 2001 from http://www.tadda.wsu.edu/avera/ description.htm

Camp, W. G. (2000). President's message [Electronic version]. *Beacon, 34*(2). Retrieved September 6, 2001, from http://www.tadda.wsu.edu/avera/ BeaconV34.pdf

Doherty, J. (1998). *Globalisation: Implications for vocational education and training* [Professional development activity sheet]. Retrieved September 6, 2001, from http://www.curriculum.edu.au/vertis/eninfo/profess/workunit/activity/act1_1.htm

Freeland, B. (2000). International comparisons of vocational education and training [Electronic version]. Leabrook, Australia: National Centre for Vocational Education Research.

Friedman, T. R. (1999). *The Lexus and the olive tree: Understanding globalism*. New York: Anchor Books.

Geiss, C. C., & Schmidt, K. (1999). German experience in easing the transition from school to early careers. *Journal of Vocational Education Research, 24*(3), 123-131.

Herr, E. L. (2000). Collaboration, partnership, policy, and practice in career development [Electronic version]. *The Career Development Quarterly, 48,* 293-300.

Hobart, B. (1999, November). *Globalisation and its impact on VET: Review of research* [Executive summary]. Leabrook, Australia: National Centre for Vocational Education Research. Retrieved from http://www.ncver.edu.au/cgi-bin/gda.pl?id=1411/research/proj/nr8020e.htm

International Labour Organization. (1997). Global unemployment crisis continues, wage inequalities rising [Electronic version]. *World of Work, 18*.

Lankinen, T. (1999, April). *Challenges to vocational education and training in the Nordic countries*. Paper presented at the Second International Congress on Technical and Vocational Education, Seoul, South Korea. Retrieved September 11, 2001, from http://www.unevoc.de/congress/pdf/lankinen.pdf

Schmidt, H. (1999, April). *Challenges to technical and vocational education*. Paper presented at the Second International Congress on Technical and Vocational Education, Seoul, South Korea. Retrieved September 11, 2001, from http://www.unevoc.de/congress/pdf/schmidt.pdf

Sellin, B., & Grollman, P. (1999). The state of European vocational training research, its functions and its problems [Electronic version]. *European Journal for Vocational Training, 17,* 69-75.

Simon Fraser University. (1999, November). *Internationalization for the new millennium.* Burnaby, British Columbia, Canada: Author. Retrieved September 6, 2001, from http://www.sfu.ca/international/ statement

Stead, G. B., & Harrington, T. F. (2000). A process perspective of international research collaboration [Electronic version]. *The Career Development Quarterly, 48,* 323-331.

Thomas, H. (2000). Keeping on track to the future [1999 Presidential Address]. *Journal of Vocational Education Research, 25,* 4-20.

UNESCO. (1999). *International cooperation.* One in a series of 29 booklets documenting workshops held at the Fifth International Conference on Adult Education. Hamburg, Germany: Author, Institute for Education.

Williams, E. (1997). How women experience social support as mature adult learners in a vocational setting. *Journal of Vocational Education Research, 22,* 39-53.

Wonacott, M. E. (2000). *Vocational education research trends* [Electronic version: Trends and Issues Alert No. 15]. Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education. Retrieved September 11, 2001, from http://ericacve.org/docgen.asp?tbl=tia&ID=

Zeszotarski, P. (2001). Issues in global education initiatives in community colleges. *Community College Review, 29*(1), 65-77.

Author Note

Jay W. Rojewski is Professor in the Department of Occupational Studies at the University of Georgia, Athens, Georgia 30602-4809. [E-mail: rojewski@uga.edu]. He served as President of the American Vocational Education Research Association in 2002 and is a past editor of the Journal of Vocational Education Research.

Journal of Vocational Education Research, 28(1), pp. 15-34.

Applied Technology Proficiency of High School Students in Applied and Traditional Courses

Dennis W. Field
Iowa State University

Abstract

This investigation compares applied technology skill levels of high school students enrolled in various applied and comparable traditional courses, particularly Principles of Technology and physics courses respectively. Outcomes from ACT's Applied Technology Work Keys® assessment test were used as a measure of applied technology skill levels. Data were collected on 529 students from intact classes at six Iowa high schools. Multilevel models were used to analyze student, class, and school level data. Group means for grade point averages and Iowa Test of Educational Development scores were higher for students enrolled in physics than for students enrolled in Principles of Technology. Principles of Technology courses appear to be reaching students who may not otherwise have enrolled in traditional physics, and reaching them at an earlier age. Applied Technology test scores were essentially equivalent for students in applied classes as compared to students in corresponding traditional classes when the model includes control variables for gender, GPA, ITED score, and prior coursework in science and mathematics.

Employers are not satisfied with the level of high school graduates' employability skills (e.g., Goldberger & Kazis, 1996; ACT Center for Education and Work, 1995; Secretary's Commission on Achieving Necessary Skills [SCANS], 1991). At the national level, the 1991 SCANS report suggests that employers take a more active role in addressing this problem by telling educators what they need and working with them (p. viii). The fundamental forces, which have been driving the employability skills issue nationally, are also at work at the state level. In Iowa, for example, the Iowa Business Council (IBC)—a non-profit, politically independent group composed of the leadership from approximately 20 major Iowa employers–initiated a project in 1993 that was consistent with SCANS goals. The project sought to improve communications with educators and to quantify both the nature and levels of skills needed by high school graduates to qualify for certain entry-level positions in their member companies.

The IBC project was undertaken with the help of the ACT's Center for Education and Work. ACT has developed a system to quantitatively measure certain employability skills, including skills in the applied technology area where individuals are asked to demonstrate an ability to apply traditional physics concepts to work-related technical problems. The ACT system, Work Keys®[1], includes job profiling and work-related assessments, and is designed to serve a variety of needs in both industrial and educational arenas. Educators can use the Work Keys® information to develop appropriate curricula and instruction that target skills needed in the workplace (ACT, 1997).

Criticisms notwithstanding, a case can be made that educators have long recognized the importance of preparing students for work (Bennett, 1926, 1937). Educators have been involved in various technical and vocational initiatives, such as School-to-Work and Tech Prep, in an effort to be more responsive to the needs of students, parents, and employers, and to close the gap between education and employability skills. Applied academics[2], which, according to Hershey, Owens, and Silverberg (1995) is a component of Tech Prep, is one of the initiatives Iowa high schools are pursuing. Roughly 71% of the 362 high schools surveyed in Iowa during the 1995-96 school year offered at least one applied academics course (Dugger, Lenning, Field, & Wright, 1996). While there is favorable anecdotal evidence of the impact of applied academic courses (H. H. Custer, personal communication, August 31, 1995), there appears to be a limited number of studies quantitatively assessing outcomes. Dare (2000) submits that few studies have offered substantial empirical evidence of the effects of applied academics on student learning and of ways in which applied academics benefit learners. She states that there is "little documentation of student outcomes associated with applied academics in the extant literature" (p. 320). Relevant studies that have been conducted compared students enrolled in the applied Principles of Technology (PT) course with students enrolled in traditional academic courses (Dugger & Johnson, 1992; Dugger & Meier, 1994; Wang & Owens, 1995). Generally favorable results for students enrolled in applied courses versus traditional courses have been reported. Studies by Dugger & Johnson (1992) and Dugger & Meier (1994) described higher levels of student achievement on technology achievement tests by PT students than by traditional physics students. Wang & Owens (1995) stated that PT students performed as well as their traditional counterparts on a combined physics and technology test when the variables for overall GPA and grades in mathematics and science were controlled.

The relative scarcity of comparative data for students enrolled in applied academics versus traditional academics indicates a need for this information, particularly given the recent climate of curricular reform and the level of implementation of applied programs in high schools. In addition, advances in the field of multilevel models offer improved analytical procedures for data of this nature. This causal-comparative study (Issac & Michael, 1995) was designed to acquire, compare, and contrast multilevel data for students enrolled in high school applied academic and traditional academic courses. Two areas were the focus of the data collection activity: (a) student demographics and (b) students' ability to apply traditional physics concepts to work-related problems.

Method

Participants

The sample for the study was drawn from a population of high school students, grades 9 through 12, enrolled in Iowa public high schools during the 1995-1996 school year. During the initial stages of the project, each of the 15 Iowa regional tech prep coordinators was asked to recommend four high schools in her or his region perceived to have representative applied academics programs with significant proportions of their student bodies participating in applied academics. At various times during the selection process, meetings were held with these regional coordinators to address questions and ensure that consistent program and course definitions were employed. The schools chosen for the study were selected from this list of approximately 60 Iowa high schools. Representatives from all 60 high schools recommended by the coordinators were phoned regarding the applied academics courses offered. The final cut to six schools was made after looking at several school characteristics, including class size and the willingness of teachers, administrators, and students to participate in the study; and whether the instructional methods were 100% applied, 100% traditional, or some blend of the two methods. Students were included in this study as a result of their pre-existing enrollment in either applied academics courses or equivalent traditional courses. The data were sorted according to applied or traditional course enrollment. The sample included 529 students from 48 intact[3] classes. Of these 529 students, 391 reported Iowa Test of Educational Development[4] (ITED) scores, and 523 had Grade Point Average (GPA) figures available. Only one student was missing both ITED and GPA scores. Students were also asked to self-report the number of units of math, science, and technology they had completed at the time of test administration: 371 reported the number of math units completed, 365 the number of science units, and 343 the number of technology units. Accommodations were made in the analysis on a case-by-case basis for those students providing incomplete data. Individual student data series were eliminated when the analysis included variables for which the student did not supply data. When the analysis was restricted to variables for which the student did supply data, that information was retained, even if the student had missing data with respect to other variables. For example, one could look at the distribution of all 522 students providing GPAs, when GPA was the variable of interest, even if only 384 reported both GPA and Iowa Tests of Educational Development (ITED) scores.

Instrument

The instrument used to indicate a student's ability to apply traditional physics concepts to work-related problems (the dependent variable) was the Work Keys Applied Technology (AT) test. The test score served as the measure of a student's technology skill level. As described in the Work Keys Preliminary Technical Handbook (ACT, 1997):

> The *Applied Technology* assessment measures the examinee's skill in solving problems of a technological nature. The content covers the basic principles of mechanics, electricity, fluid dynamics, and thermodynamics as they apply to machines and equipment found in the workplace. Because the assessment is oriented toward reasoning rather than mathematics, any calculations required to solve a problem can be readily performed by hand. The emphasis is on identifying relevant aspects of problems, analyzing and ordering those aspects, and applying existing materials or methods to new situations.
>
> This assessment contains questions at four levels of complexity, with Level 3 being the least complex and Level 6 being the most complex. Although Level 3 is the least complex, it still assesses a level of applied technology skill well above no skill at all. The levels build on each other, each incorporating the skills assessed at the preceding levels. Examinees are given 45 minutes to answer 32 multiple-choice questions. (p. 70)

Estimates of reliability parameters for the AT assessment test are included in ACT's Preliminary Technical Handbook (ACT, 1997). The coefficient alpha for the AT assessment is reported as .80 (ACT, 1997, p. 36), although a qualifier is added pertaining to the multi-dimensionality of the test. ACT explains that this assessment includes mechanical, electrical, thermodynamic and fluid dynamic topics, which tends to lower the internal consistency of the assessment, but may enhance the validity with respect to job performance (ACT, 1997, p. 37).

The approach followed by ACT with respect to content validation was to use panels of qualified content domain experts in the test development process. The development process included input by advisory panels composed of business people and educators knowledgeable in the topic areas, and examination by both content and fairness reviewers. After reviewing the results from 765 profiled jobs, ACT concluded that the results "strongly suggest" that the Work Keys skill scales are content valid for large numbers of jobs (ACT, 1997, p. 52). A more in-depth discussion of reliability and validity is included in ACT's Preliminary Technical Handbook (ACT, 1997).

Procedure

A project team worked with each school to identify and schedule specific classes to take the Work Keys assessment tests. This team also worked with individuals knowledgeable about applied academics implementation in Iowa to identify equivalent courses for comparison. The course equivalencies suggested by this group were: Applied Math I and Algebra I; Applied Math II and Algebra II, Trigonometry, or Geometry; Applied Communications and Basic Communications, Composition, or Composition and Literature; Principles of Technology I and Physics; and Applied Biology/Chemistry and Traditional Biology/Chemistry.

The following data were requested from all 529 students in the target classes during the 1995-1996 school year: (a) high school; (b) course type—applied or traditional; (c) course—math, English, physics, etc.; (d) student grade level—9 through 12; (e) student cumulative high school grade point average—0 to 4.00; (f) percentile rank of the student's ITED composite score—0 to 100; (g) number of units of math, science, and technology previously completed; and (h) specific applied and traditional courses previously taken—selected from a list. The AT test was administered to all students near the end of the 1995-1996 school year.

Once these data were collected, both descriptive analyses and exploratory data analyses (EDA) were conducted. These analyses included examination of the univariate distributions and bivariate relationships of variables. Multiple graphical procedures were employed to review the data prior to any hierarchical modeling. Residual analysis was also employed during the hierarchical modeling process. These examinations were needed to provide insight into the tenability of model assumptions, the validity of which can affect the legitimacy of statistics developed from those models.

Hierarchical Model Assumptions

1. The within-class errors for Level-1 predictor variables (such as grade level and gender) are normal and independent with class means of zero and equal variances across classes.
2. Whatever student-level predictors of employability skills (Work Keys assessment test results) are excluded from the model and thereby end up in the Level-1 error term, $e_{(ij)}$, are independent of a student's included Level-1 predictor variables.
3. The vector of residual class effects ($r_{0(j)}$, $r_{1(j)}$, $r_{2(j)}$, $r_{3(j)}$) is multivariate normal, with mean vector (0, 0, 0, 0) and its related variance-covariance matrix.

4. Whatever class-level predictors of the intercept and student-level coefficients are excluded from the model and thereby end up in the Level-2 error terms, for example $r_{0(j)}$, are independent of the included class-level (Level-2) predictor variables, such as curricula type.
5. The error at Level-1 is independent of the Level-2 error terms (Bryk & Raudenbush, 1992).

EDA uncovered outliers, which were identified during the residual analysis done as a part of hierarchical model development. These outliers (five classes and ten students) were removed from the data set.

Design

Multilevel models, based on the Hierarchical Linear Models (HLM) approach discussed by Bryk and Raudenbush (1992), were used. Data for intact classes at the student, class, and school level were gathered for analysis; however, the decision regarding the unit of analysis for the two groups of students (that is, those enrolled in applied versus traditional classes) was not clear-cut. Traditional linear model analysis assumes linearity, normality, homoscedasticity, and independence (Bryk & Raudenbush, 1992, p. xiv). Whether data are normally distributed is easily checked and nonparametric methods exist to accommodate data that do not meet the standard assumption of normality. One would have difficulty, however, making a case for the assumption of independence at the individual student level since groups of students are aggregated in classes; and to perform the analyses solely on aggregated level data ignores the wealth of within-class variation. These unit-of-analysis questions have been the focus of a number of researchers over the past 25 years (Bryk & Raudenbush, 1992; Cronbach & Webb, 1975; Iversen, 1991; Pedhazur, 1982) and multilevel models are increasingly being used to address unit-of-analysis concerns. Although it is beyond the scope of this paper to cover aspects of building and assessing hierarchical models, the fundamental reason for their use is to lessen concerns associated with the choice of a unit-of-analysis. The initial three-level (students within classes within schools) hierarchical model used is described below. The mathematical representation of a two-level model used in this study is provided in the Appendix.

Level-1: Within each classroom, students' abilities to apply physics principles to technical work-related problems (Work Keys Applied Technology assessment test scores) are modeled as a function of a number of student-level predictors, potentially including gender, grade level, ITED score, GPA, previous course work in math, science, or technology, and a random student-level error.

Level-2: Each Level-1 coefficient is modeled by classroom-level characteristics such as curricula type (applied or traditional) and relevant topic (physics and PT versus other) for a class.

Level-3: Each Level-2 coefficient is modeled by an assessment test score grand mean plus a random school-level error term.

Results

Table 1 provides the gender and grade level cross-tabulations for the two student groups, applied versus traditional. The demographics of the groups varied noticeably in two areas: The percent of students in 12th grade relative to their group, and the ratio of females to males in the samples. Students in the 12th grade comprised approximately 32% of the applied student total, but 69% of the traditional student total. In terms of female to male ratio, there were over twice as many males as females in the applied group (172:77), while there were slightly more females than males in the traditional group (145:135).

Table 1
Gender and Grade in School

	Applied Courses		Traditional Courses		
	Female	Male	Female	Male	Totals
9th	39	35	9	13	96
10th	5	46	34	17	102
11th	11	34	10	3	58
12th	22	57	92	102	273
Totals	77	172	145	135	529

One initial area of interest related to student demographics was the difference between students above and below the minimum skill level cutoff score of three on the AT test. Table 2 presents a detailed cross-tabulation of test results for students enrolled in specific courses. Overall 42% of the students scored below the minimum skill level assessed by the test. Students enrolled in physics had the best performance with only 15% scoring below the minimum skill level. Students in all other courses did not fare as well with 40% to 57% scoring below the minimum skill level.

A statistically significant gender gap also emerged with respect to the incidence of males and females falling below the minimum competency score on the test. More males than females (307:222) took the Applied Technology test, however, fewer males than females (100:121) scored below the minimum competency cutoff score of three.

Table 2
Number of Students by Course Scoring Above and Below Minimum Skill Level Cutoff on the Applied Technology Work Keys Test

Students Completing Applied Technology Test				
	Frequency of Scores			
Courses	<3	≥ 3	Totals	*<3 as % of Total*
Applied Math I	3	3	6	50%
Algebra I	0	0	0	0%
Applied Math II	2	2	4	50%
Algebra II or Geometry	0	0	0	0%
Applied Communications	26	23	49	53%
Traditional English Courses	29	44	73	40%
Principles of Technology I	43	54	97	44%
Physics	18	105	123	15%
Applied Biology/Chemistry	52	41	93	56%
Traditional Biology/Chemistry	48	36	84	57%
Totals	221	308	529	42%

Note. Using students enrolled in the traditional physics classes as an example, one can interpret this table as follows: Of the 123 students enrolled in Physics and completing the Applied Technology test, 18 students scored below Level 3 (the minimum skill level required to effectively perform certain profiled jobs) and 105 scored at or above Level 3; therefore 15% did not meet the minimum skill level assessed by the test.

Means (with standard deviations in parentheses) for ITED scores and Grade Point Averages (GPA) for students who scored below the minimum skill level score on the Applied Technology test, and for whom GPA and ITED data were available, were 36.03 (23.55) and 2.48 (0.79) respectively. The *n*s were 147 and 215 respectively. Clearly, students falling below the minimum skill cutoff score of “3” were not only those with an ITED score or GPA at the low end of the scale.

There are clear differences in the demographics and academic performance of the two groups of students in this investigation. The overall ratio of male to female students taking the Applied Technology test was 307 to 222; however the proportions were different within the applied versus traditional courses. The ratio in the group of students enrolled in applied courses was 172 males to 77 females; for the group of students enrolled in traditional courses, the ratio was 135 males to 145 females. Both ITED and GPA histograms showed traditional physics students with higher means than applied students in comparable Principles of Technology 1 courses (see Figure 1). Students enrolled in physics were almost exclusively in grade 12: Of the 123 students in physics, 121 were in grade 12, one was in grade 10, and one was in grade 11. Students enrolled in Principles of Technology were more evenly distributed through grades 10, 11, and 12 with 29, 37, and 19 students respectively. One student in grade 9 was enrolled in Principles of Technology.

During exploratory data analysis, a significant zero-order correlation ($r = .80$ at $p = .00$) was observed between two variables, ITED scores and GPA, expected to provide information regarding previous academic performance. The fact that the original two variables were highly correlated made it advisable to examine the Variance Inflation Factors (VIF) to determine if one of the variables should be removed from consideration. An Ordinary Least Squares (OLS) Regression of the Applied Technology Work Keys score on GENDER, GRADE, GPA, and ITED variables yielded VIF values between 1.030 and 2.908. Since all four variables yielded VIF values well below 10—the value suggested by Neter, Kutner, Nachtsheim, and Wasserman (1996, p. 386) as indicative of multicollinearity that may be unduly influencing the least squares estimates—none were rejected out of hand.

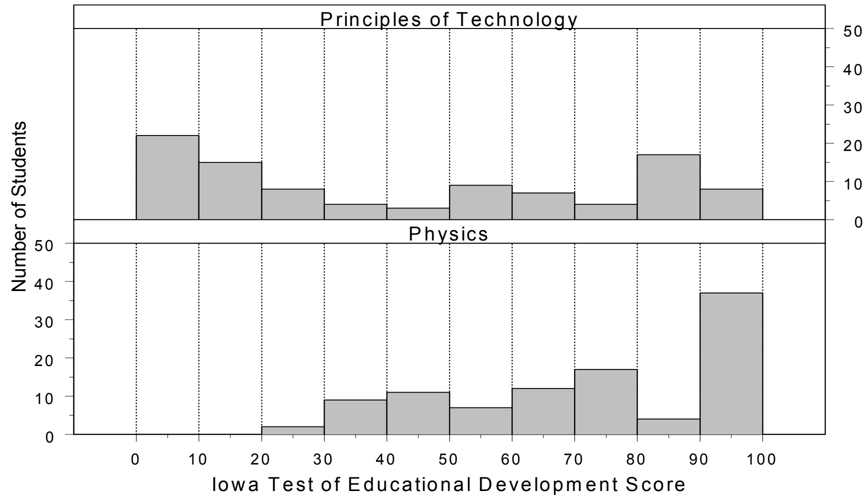
Hierarchical Models

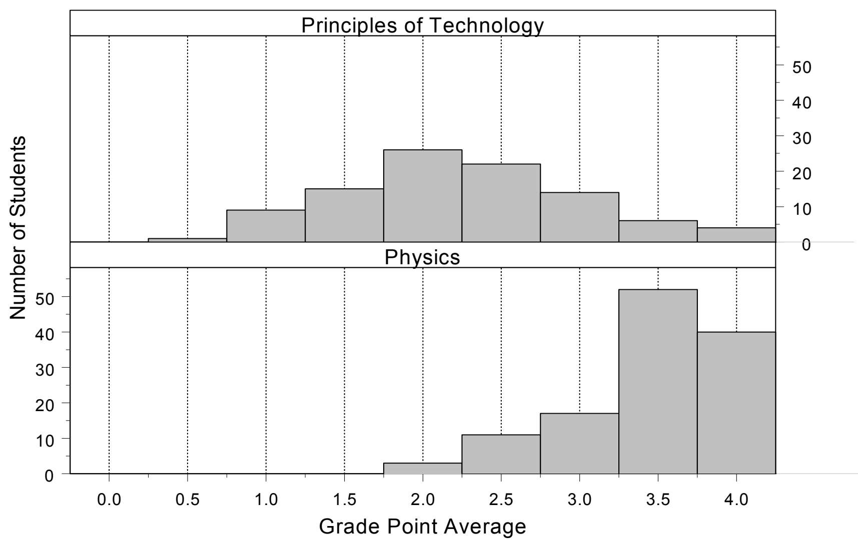
The differences in the AT test scores between the two student groups were analyzed using HLM techniques. When evaluating data, the choice of number of levels is primarily data driven. One initially looks at a fully unconditional model where one does not attempt to explain variance but simply partition it among levels. A fully unconditional model is characterized by the absence of predictor variables at all levels. In other words, the AT test score is modeled at all levels as a function of a mean score plus a random error.

The decision is then made based on the fully unconditional model as to whether the amount of variation at a specific level is enough to warrant including that level in subsequent models. During this investigation, 85% of the variance was observed at Level 1 (that is, within class or between student variation), 14% of the variance was associated with Level 2 (between classes), and only 1% was observed at Level 3 (between schools); therefore, a three-level model was rejected in favor of the less complex two-level model with Level 3 variance included in the Level 2 error term.

A variety of predictor variables were evaluated at Level 1 of the model, including ITED and GPA scores, GENDER, and GRADE (the student's year in school). Also considered at Level 1 were variables covering the self-reported number of units previously taken by students in the areas of math, science, or technology; and prior enrollment in applied math, traditional math, or physics courses. Two predictor variables were also evaluated at Level 2 of the model; TYPE (applied

Figure 1. Histograms comparing Principles of Technology 1 students' GPA and ITED scores with those of students enrolled in traditional physics.





versus traditional course) and RELVNT (a dummy variable used to indicate whether or not the course material was relevant to the material covered in the AT test—for example, physics and principles of technology courses were relevant to the AT test, while all other courses were not). No school-level predictor variables were used since the variance decomposition indicated that little of the variability associated with the test scores could be attributed to Level-3, or school-level, variables.

Applied Technology HLM Analysis

The output of the HLM analysis, with respect to estimates of coefficients, is similar to what one might find when performing a simple linear regression such as $Y = b_0 + b_1X$. Given values for X, the estimates of these coefficients may be used to predict Y-values. The estimated coefficients for significant variables in the final HLM model are provided in Table 3. Table 4 provides estimates of some additional coefficients that did not prove to be statistically significant and were removed in the final model.

The curriculum "Type" coefficient for the AT test as shown in Table 4 is –0.057 for a sample size of 25 classes. The coefficient is not significant for this data set with $p = .80$, indicating that while students enrolled in traditional courses score slightly lower on average than students enrolled in applied courses when controlling for various academic and demographic factors, that difference was not statistically significant. The significant "Relevant course" coefficient shown in Table 3 is positive, indicating that students enrolled in physics or technology courses did better on the technology test than did students enrolled in English, biology, and chemistry courses. The students enrolled in relevant courses scored on average one-half point higher than those enrolled in non-relevant courses.

Male students scored on average 0.891 points higher on the AT test than did female students. Both GPA and ITED coefficients are positive, which unsurprisingly indicates that those students with higher GPA and ITED marks earned, on average, higher scores on the AT test than did those with lower GPA and ITED marks. What was somewhat surprising, however, was that the grade level of the student—that is, whether a student was in grade 10, 11, or 12—did not yield a statistically significant result. While it might be argued that one or more of the significant variables, such as number of math and science units taken, could be correlated with grade level and thus account for differences in grade level performance, a check of the variance inflation factor for "GRADE" with other significant variables in the regression equation yielded an unremarkable 2.477.

Other statistically significant variables included the self-reported number of units of mathematics and science completed by the students. However the values of these variables ran from 0 to 10 units each and, given coefficient values of .009 and .007 for math and science units respectively, the average impact of these prior

Table 3
HLM estimates for Applied Technology data--significant variables only

Fixed Effect	*Coefficient*	*se*	*t* ratio	*p value*
Grand mean, β_{00}	0.529	0.250	2.111	.047
Relevant course, β_{01}	0.494	0.173	2.864	.010
Gender, β_{10}	0.891	0.182	4.895	.000
GPA, β_{20}	0.365	0.186	1.959	.050
ITED, β_{30}	0.016	0.005	2.904	.004
Number of Math Units, β_{40}	0.009	0.002	4.717	.000
Number of Science Units, β_{50}	0.007	0.001	6.232	.000
Prior Enrollment in Traditional Math, β_{60}	0.863	0.280	3.086	.002

Random Effect		Variance Component	*df*	χ^2	*p* value
Level 1 (Students),	$e_{(ij)}$	2.30555			
Level 2 (Classes),	$r_{0(j)}$	0.00063	21	15.179	>.500

Variance Reduction (by level) from Unconditional Model

Level 1	Students	20.1%
Level 2	Classes	99.9%

Note. Almost all (99.9%) of the class-level variation is explained by the Applied Technology model. Noting that $p > .500$ for the random effect at Level 2, one may conclude that a minimal amount of unexplained variation remains at this level.

academic components would be minimal on the overall assessment test score, a combined maximum of .160 points. The remaining statistically significant coefficient indicated that students with prior coursework in traditional mathematics scored on average 0.863 points higher on the Work Keys assessment than those without prior courses in traditional mathematics.

Once again, as was stated earlier, all data were not available for all 529 students. For example, ITED scores and self-reported data regarding number of units of mathematics and science previously taken by students were particularly prone to falling in the missing data category. In order to gain some measure of information regarding how robust the above estimates were to changes in sample size and analytical method, two iterations of both HLM and Ordinary Least Squares (OLS) regression models were employed (see Table 4). Although OLS models were not

Table 4
Comparison of HLM and OLS Coefficients

	HLM 1	OLS 1	HLM 2	OLS 2
	Sample Size			
Classes	40		25	
Students	435	369	294	216
Coefficients				
Relevant	.320*	.309	.556	.459
Type	-.132	-.217	-.057	-.044
Gender	1.016*	1.046*	.870*	.927*
Grade	.109	.102	-.053	-.023
ITED	.022*	.027*	.017*	.035*
GPA	.467*	.422*	.367	.278
Math Units			.010*	.006
Science Units			.008*	.006
Prior Traditional Math			.884*	.641

$*p \leq .05$

considered optimum for these data sets, due to concerns about the independence of student-level data within classes, the models did allow comparisons of the signs (positive or negative), magnitudes, and levels of significance of the coefficients relative to the HLM models. The results indicated that the coefficients were relatively stable, and more importantly, the type of instruction, applied versus traditional, was not significant in any of the models.

Conclusions and Discussion

Examination of the demographics and academic performance of the two groups of students in this investigation indicate clear differences. A comparison of AT test scores, without controlling for other variables, suggest a conservative Cohen's *d* effect size of .42, which falls between what Cohen (1988) would describe as a small effect size, $d = .2$, and a medium effect size, $d = .5$. However, once a student's gender and ITED score are taken into account by regressing the AT test scores on these two variables and examining the residuals, Cohen's *d* effect size drops to .04, suggesting essentially no treatment effect (applied versus traditional instruction). The fact that students enrolled in applied courses exhibit, on average, lower ITED scores and GPAs may indicate that less academically gifted (or motivated) students are steered toward the applied courses, and that applied courses are not viewed as favorably as traditional courses by students in the academic upper quartile. Indeed, this is not a unique perspective. Lakes and Burns (2001), for example, passed along a harsh assessment offered by an instructor in their study. In the instructor's view, the applied program was a dumping ground for those with learning disabilities within the population of non-college-bound students (p. 33). Dare (2000) also provides a well-documented discussion of problems associated with applied academics, including the all-to-common failure of four-year institutions to award college credit for applied academics.

In addition, the ratio of male to female students is considerably different within the applied versus traditional courses. Over twice as many male students as female students were enrolled in applied courses, while traditional courses exhibited a more even split. One outcome of the study that perhaps warrants further investigation relates to the high numbers of students (42%) scoring below the minimum competency cutoff score on the AT test. If this test is to be used to evaluate student performance in the future, researchers should be confident that the results are truly the product of a competency gap and not somehow a test validity issue.

A statistically significant gender gap emerged with respect to the incidence of males and females falling below the minimum competency score on the test. More males than females took the AT test, however, fewer males than females scored below the minimum competency cutoff score. These data are in line with results from the National Assessment of Educational Progress reported by Scaife (1998): "The performance gap in physics between 11th grade girls and boys was found to be extremely large, and it could not be explained by differential course-taking patterns . . . " (p. 63).

As regards the grade distribution of students enrolled in traditional physics versus the grade distribution of students enrolled in Principles of Technology 1, the fact that the applied course seems to be drawing students into a technical elective at an earlier age might be considered a benefit of the curriculum.

Implications for Technology Curricula

First, one should not generalize based on this study that the instructional methods yield equivalent results, or that one instructional method is "better" than the other. The use of intact groups and potential problems associated with attempting to statistically control for intact group differences would make such conclusions questionable (Pedhazur, 1982). One could also argue that the benefits of the applied instructional method go far beyond improved performance on tests (Hull, 1995) even if there were statistically significant differences in test results. Disparities do, however, exist in raw Work Keys test performance, mean GPAs, and mean ITED scores between those groups of students enrolled in applied academic courses and those groups of students enrolled in the comparable traditional academic courses. In all cases, the students enrolled in traditional courses had higher average raw scores than did the students enrolled in the comparable applied courses. To a certain extent this might be expected for the Principles of Technology courses versus physics courses, since applied courses are targeted toward the academic middle fifty-percent of high school students (CORD, n.d.; Wang & Owens, 1995) and physics is typically an elective taken by 12-graders with above-average academic performance. While this disparity might be cause for concern for some, others might be gratified to see students taking the Principles of Technology course who might not otherwise have been enrolled in any type of physics-based course. The applied PT program does appear to be reaching a different audience than the traditional physics course, and pulling them into the topic area at an earlier age. Thus, while there are significant differences between raw academic performance for those enrolled in applied academics courses as compared to students who are enrolled in equivalent traditional courses, performance on the applied technology assessment instrument is comparable for the two groups of students when certain demographic variables such as gender, GPA, and ITED scores are taken into account. Given the importance of technical competency in today's workplace and the number of students that do not appear to meet even the minimum workplace requirements (42% for the combined sample groups), a curriculum that draws in a broader audience and provides exposure to important technical concepts would seem to be a valuable contributor to developing technology competency, one of the five SCANS (1991) competencies needed to “span the chasm between school and workplace” (p. xv).

The study has yielded information that may benefit future investigations into the effectiveness of the applied academic instructional method. Longitudinal studies of each group's performance relative to a number of indices including, but not restricted to, test scores would be a start. Test scores are certainly one measure of student learning under a particular type of instructional method; however, they do not provide the whole picture. Even if average test scores of students enrolled in applied classes never reach levels observed with college-bound traditional students, one could argue that progress is being made toward the technology component of the SCANS competencies (SCANS, 1991, p. xvii) by increasing the technology literacy of students who might otherwise have never enrolled in a technology course.

The data in this study indicate the diversity of the two groups under consideration, but further work must be done to generalize the essential question of comparative performance over time. That question requires that one monitor growth of students’ technical skills. Data should be collected at periodic intervals for analysis and should include measures of performance in both school and workplace. Tracking changes over time is of particular importance if the measures of effectiveness apart from test scores, such as shifts in technical course enrollment, are to be examined. Care must also be taken in the choice of when data are collected. One data collection site reported that students, particularly seniors, were less apt to put forth their best efforts when tests were administered near the end of the school year (Dugger et al., 1996). Finally, future research should include investigation of other independent variables that may account for the significant unexplained variability related to AT test scores. These types of data are crucial to decision-makers in their efforts to evaluate the impact of applied academics in today's schools.

Appendix

One form of the two-level (students within classes) hierarchical model used in this investigation is described below. It should be noted that not all variables identified as significant in the final model are included in this example.

Level-1: Within each classroom, students' abilities to apply traditional physics-based concepts to work-related problems (Work Keys Applied Technology assessment test scores) are modeled as a function of a number of student-level predictors; for example gender, grade level, ITED scores, and a random student-level error:

$$Y_{(ij)} = \pi_{0(j)} + \pi_{1(j)}a_{1(ij)} + \pi_{2(j)}a_{2(ij)} + \pi_{3(j)}a_{3(ij)} + e_{(ij)}$$

Where

$Y_{(ij)}$ is the Work Keys test score of student *i* in class *j*.

$\pi_{0(j)}$ is the mean Work Keys score of grade 9 females with a grand-mean centered ITED score in class *j*.

$\pi_{1(j)}$ is the predicted change to mean Work Keys score in class *j* when the student is a male. This is a "gender" coefficient.

$a_{1(ij)}$ is a dummy variable associated with student gender. The coding is 0 for a female student and 1 for a male student.

$\pi_{2(j)}$ is the predicted change to mean Work Keys score in class *j* as a result of the student's grade level (9, 10, 11, or 12)

$a_{2(ij)}$ is a dummy variable associated with student grade level. The coding is 0 for a student in grade 9, 1 for a student in grade 10, 2 for a student in grade 11, and 3 for a student in grade 12. One might question the representation of grade as an interval variable in this case, as is implied by the coding, but it was considered to be a reasonable tradeoff to maintain a higher number of degrees of freedom in the model. In addition, models were run using three binary dummy variables for grade level. The grade coefficients using three binary dummy variables for grade did not prove to be significant at the .05 level either.

$\pi_{3(j)}$ is the predicted change to mean Work Keys score in classroom *j* per unit change in the student's grand-mean centered ITED score.

$a_{3(ij)}$ is the grand-mean centered ITED score of student *i* in class *j*.

$e_{(ij)}$ is a Level-1 random effect that represents the deviation of student *ij*'s score from the predicted score. These residual effects are assumed normally distributed with a mean of 0 and a variance of σ^2.

Level-2: Each Level-1 coefficient is modeled by some classroom-level characteristics such as curricula type (applied or traditional) and relevant topic (technology or non-technology) for a specific class.

$$\pi_{0(j)} = \beta_{00} + \beta_{01}X_{1(j)} + \beta_{02}X_{2(j)} + r_{0(j)}$$

$$\pi_{1(j)} = \beta_{10}$$

$$\pi_{2(j)} = \beta_{20}$$

$$\pi_{3(j)} = \beta_{30}$$

Where

β_{00} is the grand mean Work Keys test score of grade 9 females with grand-mean centered ITED score in applied non-technology courses.

β_{01} is the predicted change to overall class mean Work Keys test scores of grade 9 females with grand-mean centered ITED scores in non-technology courses from the grand mean Work Keys test score when traditional curricula are used rather than applied curricula. This is a "curricula-gap" coefficient.

$X_{1(j)}$ is a variable associated with curriculum type used in classroom *j*. The coding is 0 for an applied and 1 for a traditional course.

β_{02} is the predicted change to overall class mean Work Keys test scores of grade 9 females with grand-mean centered ITED scores in non-technology courses from the grand mean Work Keys test score when the applied course is a technology course rather than a non-technology course. This is a "relevant course" coefficient.

$X_{2(j)}$ is a dummy variable used to identify whether or not a course is "relevant" to the Work Keys test taken . The coding is 0 for a non-relevant course and 1 for a relevant course.

$r_{0(j)}$ is a Level-2 random effect that represents the deviation of class *j*'s Level-1 intercept coefficient from its predicted value based on the Level-2 model. The random effects in Level 2 equations are assumed multivariate normal with a mean of 0. The variance of this effect is designated as τ_π.

β_{10} is the mean slope, averaged across classes, relating student gender to

Work Keys score. When the coefficient is considered a fixed effect, as it is here with $\pi_{1(j)}$ assumed equal to β_{10}, it implies that there are not statistically significant differences in the relationship between a student's gender and the Work Keys test score from class to class within a school.

β_{20} is the mean slope, averaged across classes, relating student grade to Work Keys score.

β_{30} is the mean slope, averaged across classes, relating students' grand-mean centered ITED scores to Work Keys score.

References

ACT Center for Education and Work. (1995). *Making the grade: Keys to success on the job in the 90s* [Brochure]. Iowa City, IA: Author.

ACT. (1997). *Work keys preliminary technical handbook*. Iowa City, IA: Author.

Bennett, C.A. (1926). *History of manual and industrial education up to 1870*. Peoria, IL: Chas. A. Bennett Co., Inc.

Bennett, C.A. (1937). *History of manual and industrial education: 1870-1917*. Peoria, IL: The Manual Arts Press.

Bryk, A.S. & Raudenbush, S.W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Newbury Park, CA: SAGE.

CORD. (n.d.). *Principles of technology: A contextual approach to workplace physics* [Brochure]. Waco, TX: Author.

Cronbach, L. J., & Webb, N. (1975). Between-class and within-class effects in a reported aptitude x treatment interaction: Reanalysis of a study by G. L. Anderson. *Journal of Educational Psychology, 67*(6), 717-724.

Dare, D. E. (2000). Revisiting applied academics: A review of a decade of selected literature. *Journal of Vocational Education Research, 25*(3), 296-332.

Dugger, J. & Johnson, D. (1992). A comparison of principles of technology and high school physics student achievement using a principles of technology achievement test. *Journal of Technology Education*, *4*(1), 19-26.

Dugger, J. C., Lenning, O. T., Field, D. W., & Wright, A. (1996). *Report to the Iowa Department of Education: Statewide pilot study and development of a model for evaluating applied academics across Iowa*. Ames, IA: Iowa State University, Department of Industrial Education and Technology.

Dugger, J. & Meier, R. (1994). A comparison of second-year principles of technology and high school physics student achievement using a principles of technology achievement test. *Journal of Technology Education*, 5(2), 5-14.

Goldberger, S. & Kazis, R. (1996). Revitalizing high schools: What the school-to-career movement can contribute. *Phi Delta Kappan*, 77(8), 547-554.

Hershey, A., Owens, T., & Silverberg, M. (1995). *The diverse forms of tech-prep: Implementation approaches in ten local consortia*. (MRP reference: 8087). Princeton, NJ: Mathematica Policy Research.

Hull, D. (1995). *Who are you calling stupid?* Waco, TX: Center for Occupational Research and Development.

Isaac, S. & Michael, W.B. (1995). *Handbook in research and evaluation: A collection of principles, methods, and strategies useful in the planning, design, and evaluation of studies in education and the behavioral sciences* (3rd ed.). San Diego, CA: EdITS

Iversen, G. R. (1991). *Contextual analysis*. Newbury Park, CA: SAGE.

Lakes, R. D., & Burns, J. Z. (2001). “It’s like their culture:” Resistant boys in the new vocationalism. *Journal of Industrial Teacher Education, 38*(4), 25-40.

Neter, J., Kutner, M. H., Nachtsheim, C. J., & Wasserman, W. (1996). *Applied linear statistical models* (4th ed.). Chicago: Irwin.

Pedhazur, E.J. (1982). *Multiple regression in behavioral research: Explanation and prediction* (2nd ed.). New York: CBS College Publishing.

Scaife, J. (1998). Science education for all? Towards more equitable science education. In A. Clark & E. Millard (Eds.), *Gender in the secondary curriculum: Balancing the books* (pp. 60-79). London: Routledge.

Secretary’s Commission on Achieving Necessary Skills [SCANS]. (1991). *What work requires of schools: A SCANS report for America 2000*. Washington, DC: U.S. Department of Labor.

Wang, C., & Owens, T. (1995). *The Boeing Company applied academics project evaluation: Year four. Evaluation report*. Portland, OR: Northwest Regional Educational Laboratory. (ERIC Document Reproduction Service No. 381892)

---

1 Work Keys Tests are a series of tests designed to assess personal skill levels in important areas of employability skills (ACT, 1997). There are currently eight tests: (a) Applied Mathematics, (b) Applied Technology, (c) Listening, (d) Locating Information, (e) Observation, (f) Reading for Information, (g) Teamwork, and (h) Writing.

2 Applied academics courses (Hull, 1995) are those developed by the Center for Occupational Development (CORD) or the Agency for Instructional Technology (AIT). The courses are entitled Principles of Technology, Applied Biology/Chemistry, Applied Mathematics, and Applied Communications. Applied

courses target the middle 50% of the typical high school student body, incorporate contextual examples, and help students master essential academic knowledge through practical experience (Parnell, 1992).

3 For purposes of this project, the term "intact class" indicates a situation where students who are already enrolled in existing applied or traditional classes are observed rather than randomly assigned to applied or traditional courses. This results in the research being classified as quasi-experimental.

4 *Iowa Test of Educational Development* (ITED) is a standardized test designed to assess current performance in reading, language, and mathematics. Individual achievement is determined by comparison of results with average scores derived from large representative samples and is communicated as a percentile rank score.

Author Note

This investigation uses secondary data collected during a study supported in part by the Iowa Department of Education. Dr. Jan Sweeney, Dr. Mandi Lively, and Mari Kemis of the Research Institute for Studies in Education at Iowa State University were involved in the initial aspects of that study. Team members, besides the author, who were involved throughout the Iowa Department of Education project included Dr. John Dugger, Dr. Oscar Lenning, and Ms. Andrea Wright. A portion of the data collected during that project formed the basis for the author's doctoral dissertation and this manuscript. Dr. Fred Lorenz also deserves recognition for his counsel during the time statistical techniques were being investigated. Finally, thanks to Dr. Michael Dyrenfurth, Dr. Steven Freeman, and Dr. Mack Shelley for critiquing this manuscript. The efforts of all are gratefully acknowledged. Correspondence concerning this article should be addressed to Dennis W. Field, Iowa State University, 216 Industrial Education II, Ames, Iowa 50011-3130. Field may be reached by phone at (515) 294-6332, by fax at (515) 294-1123, and by e-mail at dwfield@iastate.edu

Journal of Vocational Education Research, 28(1), pp. 35-57

Evaluating Tech Prep Education Programs: Implications for Reporting Program and Student Outcomes

Sheila K. Ruhland
University of Minnesota

Abstract

Tech Prep education programs play a vital role in the education of American youth. During the past decade, with funding from the Perkins Act, Tech Prep consortia have consolidated and developed programs for students. The Carl D. Perkins Vocational and Technical Education Act of 1998 required each state to identify performance levels relevant to career and technical education. Seven essential program elements and four core indicators provide the foundation to evaluate Tech Prep education programs. This work is based upon a review and synthesis of state and local Tech Prep evaluation efforts. This paper will identify an evaluation model to guide those responsible for the planning, data collection, and analysis of Tech Prep program and student outcomes data.

Introduction

The Carl D. Perkins Vocational and Technical Education Act provides federal funds " . . . to help provide vocational-technical education programs and services to youth and adults" (U.S. Department of Education, n.d., How is the Perkins Act administered by the education department, ¶ 2). Funds from the Perkins Act are awarded to state education agencies and have supported the development and expansion of Tech Prep education programs. Nationally, between 1991 and 1997, more than 1,000 Tech Prep consortia were created, covering approximately 70% of secondary school districts and serving about 90% of all U.S. American high school students (Hershey, Silverberg, Owens, & Hulsey, 1998). Perkins reauthorization in 1998 required states to assess the effectiveness of achieving the goals outlined in their State plan. For most states this meant the need to develop an evaluation plan and to identify the data to collect to be accountable for the use of Federal funds.

The planning, data collection, and analysis of Tech Prep data at the local, state, and national level has been minimal. Research conducted by Bragg (1997) with state and local Tech Prep coordinators indicated that time, resources, and turnover of local Tech Prep coordinators are factors that impact their efforts to collect and report Tech

Prep data on an annual basis. Bragg further reported that recent evaluations of Tech Prep education programs identified many promising trends and challenges:

> Of nearly 50% of all local Tech Prep consortia in the United States, 40% reported they had not even begun to implement formal evaluations of their Tech Prep programs. Another 30% indicated their consortia were in the planning stage of evaluation, showing only a minority of Tech Prep consortia were actively implementing formal evaluations, and most of these were very preliminary. (p. 7)

Research indicates that, although Tech Prep program implementation has been widespread, the reporting of student outcomes is unclear or limited (Bragg, Puckett, Reger, Thomas, Ortman, & Dornsife, 1997; Silverberg, Hulsey, & Hershey, 1997). A four-year longitudinal study began in January 1998 to better understand the relationship between Tech Prep program implementation and reporting of student outcomes (Bragg, 2001). Data collected from eight Tech Prep consortia assessed Tech Prep initiatives and how they influenced students' educational experiences and outcomes. "On average, Tech Prep enrolled about 15 percent of the high school students in these selected consortia during the 1996-97 academic year, and have undoubtedly grown more since that time" (Bragg, 2001, p. ix). Results indicated that a least 65% of the Tech Prep participants enrolled in postsecondary education within one and three years of high school graduation.

Most consortia report plans to develop comprehensive student databases, but thus far they have not implemented them (Silverberg, et al., 1997). Research conducted by Brown, Pucel, Twohig, Semler, and Kuchinke (1998) identified two major problems related to Tech Prep evaluation efforts: (a) a lack of specific definitions or criteria to identify a Tech Prep student, and (b) a lack of consistent processes to identify a Tech Prep student. A national Tech Prep study conducted by Ruhland, Custer, and Stewart (1995) concluded that Tech Prep student identification is a critical factor in implementing systemic change in Tech Prep education programs. Without a Tech Prep student definition, consortia are unable to identify the data required to report and evaluate Tech Prep program and student outcomes data. This leads to the inability to evaluate and report Tech Prep education program results within secondary schools and two-year colleges.

The Tech-Prep Education Act does not provide a definition of a Tech Prep student, concentrator, or completer (U.S. Department of Education, 1998). The need to develop a state definition would provide consistent and useful Tech Prep program and student outcomes data. When a range of Tech Prep definitions are used difficulties emerge. Barnett (2002) states, " . . . when data from students identified under different systems is compiled together, the resulting information is not very useful" (p. 61). The task of defining a Tech Prep student has not been easy, and most states continue to struggle with developing a definition.

The National Association of Tech Prep Leadership (NATPL) developed definitions for Tech Prep secondary and postsecondary students by surveying state

Tech Prep coordinators. The NATPL Executive Committee and Research Committee (C. Jurgens, personal communication, November 14, 2000) provided the following definitions. A Tech Prep secondary student has indicated a Tech Prep career pathway and is enrolled in a Tech Prep course of study that: (1) includes a technical component; (2) consists of a minimum of two years secondary and two years of postsecondary study; (3) is carried out under a written articulation agreement; (4) may allow the student to earn postsecondary credit while in secondary school; and (5) leads to a specific postsecondary two-year certificate, degree, technical diploma, apprenticeship, or baccalaureate degree.

A Tech Prep postsecondary student is enrolled in a two-year certificate, degree, technical diploma, or apprenticeship program and has participated in a secondary Tech Prep course of study that: (1) included a technical component, (2) consisted of a minimum of two years at the secondary level, (3) was carried out under a written articulation agreement, and (4) may have allowed the student to transfer in postsecondary credit earned at the secondary school. NATPL defines Tech Prep completer as a student who has participated in both the secondary and postsecondary portions of the recognized education plan and has received an appropriate postsecondary two-year certificate, degree, technical diploma, or apprenticeship license.

Purpose

The primary purpose of the work described herein was to identify and recommend a Tech Prep evaluation model to assist state and local Tech Prep personnel with the evaluation of Tech Prep education programs. Due to the variability of state and local Tech Prep evaluation requirements, consortia have considerable flexibility in designing an evaluation model to meet their individual needs. A secondary purpose was to identify Tech Prep program outcomes data to assist with the evaluation of the Tech Prep seven essential program elements, and Tech Prep student outcomes data to assist with the evaluation of the Perkins four core indicators to meet the accountability reporting requirements of the Carl D. Perkins Vocational and Technical Education Act of 1998.

Literature Review

The literature review presents an analysis of four evaluation models, describes the Tech Prep seven program elements, and defines the Perkins four core indicators for performance reporting.

Evaluation Models

Evaluation is defined as "a systematic study of a particular program or set of events over a period of time in order to assess effectiveness" (Hitchcock & Hughes, 1989, p. 7). Program evaluations assess how well a program has worked in terms of its stated goals. Methods of evaluation range from individual reviews of performance to statewide assessments. Evaluation may occur at regular intervals throughout a program to measure progress (formative), or may occur at the end of a time period to summarize the results (summative) (Dutton, Hammons, Hudis, & Owens, 1994).

A critical aspect of program evaluation is designing an evaluation model. "An evaluation model not only provides the overall framework for evaluation but also gives shape to the research questions, organizes and focuses the evaluation, and informs the process of inquiry" (Conrad & Wilson, 1985, p. 19). Previous research has not identified any one model as the best approach to evaluating Tech Prep education programs. Table 1 provides a summary of four evaluation models and identifies the individuals who have written about the model, primary uses of each model, and the benefits and limitations of each evaluation model (Worthen, Sanders, & Fitzpatrick, 1997).

Table 1
Analysis of Evaluation Models

	Objectives-Oriented	**Management-Oriented**	**Expertise-Oriented**	**Participant-Oriented**
1. Some Proponents	Tyler Provus Popham	Stufflebeam Alkin Provus	Eisner Accreditation Groups	Stake Guba and Lincoln Parlett and Hamilton
2. Purpose of Evaluation	Determining the extent to which objectives are achieved.	Providing useful information to aid in making decisions.	Providing professional judgments of quality.	Understanding and portraying the complexities of a programmatic activity, responding to an audience's requirements for information.
3. Distinguishing Characteristics	Specifying measurable objectives; using objective instruments to gather data; looking for discrepancies between objectives and performance.	Serving rational decision making; evaluating at all stages of program development.	Basing judgment on individual knowledge and experience; use of consensus standards, team/site visitations.	Reflecting multiple realities; use of induction reasoning and discovery; firsthand experience on site.

	Objectives-Oriented	Management-Oriented	Expertise-Oriented	Participant-Oriented
4. Past Uses	Program development; monitoring participant outcomes; needs assessment.	Program development; institutional management systems; program planning; accountability.	Self-study; blue-ribbon panels; accreditation; examination by committee; criticism.	Examination of innovations or change about which little is known, ethnographies of operating programs.
5. Benefits	Ease of use; simplicity; focus on outcomes; high acceptability; forces objectives to be set.	Comprehensive-ness; sensitivity to information needs of those in a leadership position; systematic approach to evaluation; use of evaluation throughout the process of program development; well operationalized with detailed guidelines for implementation; use of a wide variety of information.	Broad coverage; efficiency (ease of implementation, timing) capitalizes on human judgment.	Focus on description and judgment; concern with context, openness to evolve evaluation plan; pluralistic; use of inductive reasoning; use of a wide variety of information; emphasis on understanding.
6. Limitations	Oversimplification of evaluation and programs; outcomes-only orientation; reductionistic; linear; overemphasis on outcomes.	Emphasis on organizational efficiency and production model, assumption of orderliness and predictability in decision making; can be expensive to administer and maintain; narrow focus on the concerns of leaders.	Replicability; vulnerability to personal bias, scarcity of supporting documentation to support conclusions; open to conflict of interest; superficial look at context; overuse of intuition; reliance on qualifications of the "experts".	Nondirective; tendency to be attracted by the bizarre or atypical; potentially high labor-intensity and cost; hypothesis generating; potential for failure to reach closure.

Note. Adapted from Worthen, Sanders, and Fitzpatrick, 1997, pp. 179-181.

The objectives-oriented model (Worthen, et al., 1997) determines the extent to which objectives are being achieved. This model has measurable objectives and uses instruments to gather data. The management-oriented model (Worthen, et al.) assists with decision-making. This model evaluates all stages of program development and is often used for accountability. The expertise-oriented model (Worthen, et al.) provides professional judgments and is often used with self-study and accreditations. The participant-oriented model (Worthen, et al.) responds to an audience's requirement for information. This model focuses on description and judgment, with emphasis on understanding the information collected.

An important purpose of conducting a Tech Prep evaluation is to enhance program improvement. Evaluation processes should be integrated into Tech Prep education program planning so that the results of the evaluation can be used to guide decision-making and future planning. Ultimately, this should lead to action involving "program change, innovation or improvement" (Barak & Breier, 1990, p. 58). Three strategies are described to link Tech Prep evaluation results with program improvement: action-planning, continuous quality improvement, and Malcolm Baldrige.

Action-planning. Action-planning helps individuals or groups follow through on what they have learned following the program evaluation. This evaluation strategy can be initiated at the state or local consortium level and involves participants from secondary schools and two-year colleges. Action-planning starts by engaging stakeholders in reflecting carefully on the results of the evaluation and putting the results into context. This process identifies the strengths and weaknesses of the Tech Prep education program and the evaluation process. Following this reflection, stakeholders prioritize the issues and set new goals, focusing on activities that have a high impact on student and program outcomes.

Once the priorities are set, the action plan can be developed. A typical action plan often describes the goals, objectives, strategies to address those objectives, potential barriers, and needed resources (human, technical, and funding). The action plan describes the state deliverables, responsibilities, and timelines for achieving the goals. Criteria and monitoring methods (e.g., who, when, how) should be specified. Ultimately, the action plan should provide the framework for achieving the Tech Prep education program goals.

An example of a consortium that has incorporated action-planning is the Mid-Minnesota's School-to-Career/Tech Prep (Schroeder, 2000). The consortium planning starts with the Tech Prep leadership team identifying the goals for each of Minnesota's seven Tech Prep indicators. The Tech Prep leadership team identifies the strategies to assist the nine secondary schools within the consortium to develop their local plans. Each secondary school has the flexibility of identifying the individuals responsible for completing the action plan. The plan is designed to meet the individual secondary school's needs. Resources are identified for each strategy. During the spring, summaries of the action-planning results are submitted to the local Tech Prep consortium director. The nine secondary schools meet to discuss their individual activities and the goals achieved.

Continuous quality improvement. Continuous quality improvement (CQI) is an approach to quality management that focuses on the process rather than the individual. CQI stems from a range of sources including the quality movement, total quality management, and the Japanese *kaizen* view of quality which focuses on the process rather than the results (Dixon & Swiler, 1990). Tech Prep consortia can apply this strategy by involving a range of consortium members when conducting the Tech Prep program evaluation.

Tech Prep's definition of *quality* may be defined by legislation or local, regional, or state policies. Data collected to evaluate Tech Prep education programs should document state or local consortia quality indicators. The National Association of Tech Prep Leadership (NATPL) (1999, 2003) has developed a list of quality indicators to provide a consistent vision for Tech Prep education programs. The quality indicators are written for five integral Tech Prep program components: (a) accountability/sustainability, (b) student opportunities, (c) curriculum, (d) articulation, and (e) professional development. These indicators provide a benchmark for Tech Prep continuous quality improvement.

Texas has developed a minimum of two quality measures for each of the 10 review areas included in their Tech Prep consortium site visit (Texas Higher Education Coordinating Board, 2000). A site visit includes the review of each measure. The reviewer rates each measure as “meets standard” or “does not meet standard.” As a result, measures meeting the standard can be expanded, and measures that do not meet the standards can be addressed and corrected. This process permits the consortium to be in a continuous quality improvement cycle.

Malcolm Baldrige. The Malcolm Baldrige National Quality Award provides criteria as a management guide for quality improvement in America (Baldrige National Quality Program, n.d.). Ross (1993) states that the common themes of the Malcolm Baldrige award are customer-driven quality, continuous improvement, measurement, participation, leadership, and management by data (rather than experience or intuition). Within the Malcolm Baldrige National Quality Program criteria has been identified for U.S. Education Organizations to improve their performance. The core values and concepts for educational excellence are embodied in seven categories and include: (a) leadership, (b) strategic planning, (c) student and stakeholder focus, (d) information and analysis, (e) faculty and staff focus, (f) educational and support process management, and (g) organizational and performance results. The criteria focus on five organizational performance areas: (a) student performance results, (b) student and stakeholder focused results, (c) budgetary and financial results, (d) faculty and staff results, and (e) organizational effectiveness results. The Baldrige Education Criteria for Performance Excellence provide a valuable framework to assess and measure Tech Prep education programs.

In Minnesota, a Tech Prep Self-Evaluation System model (Pucel, Brown, & Kuchinke, 1996) was designed using the Malcolm Baldrige National Quality Award criteria. The model “ . . . was designed to gather data on program outcome measures to monitor actual consortium productivity, and to gather self-evaluation data as a basis for program improvement” (p. 82). Tech Prep stakeholders were involved in the process, and data were collected to help consortia effectively identify areas of improvement.

Tech Prep Seven Program Elements

The evaluation of Tech Prep education programs offers many benefits, including the compliance with the rules and regulations of the federal act. Two key benefits are improving programs and providing accountability (Boulmetis & Dutwin, 2000; Connell & Mason, 1995; Logan, 1999). Section 204 of the Carl D. Perkins Vocational and Technical Education Act 1998 (U.S. Department of Education, 1998) outlines the content for Tech Prep education programs. Each consortium receiving Perkins funding is required to submit as part of its state plan a five-year plan for the development and implementation of Tech Prep education programs. Evaluating Tech Prep for program improvement purposes will enable state and local consortia to identify both strengths and areas for improvement. Program improvement efforts can be targeted for short-term (i.e., less than one year) or long-term (i.e., more than a year) planning and implementation.

State and local consortia will need to collect program outcomes data for each of the Tech Prep seven essential program elements required in Perkins II and Perkins III. The seven elements are: (a) articulation agreement, (b) appropriate curriculum design, (c) curriculum development, (d) in-service teacher training, (e) counselor training, (f) equal access for special populations, and (g) preparatory services. A brief description of each Tech Prep program element follows.

Articulation agreements. The Perkins Act (Section 204) requires that each Tech Prep education program be carried out under an articulation agreement between the participants in the consortium (U.S. Department of Education, 1998). The articulation agreements link secondary schools with 2-year postsecondary institutions through nonduplicative sequences of courses in career fields. Some states have developed one articulation agreement for all schools in the consortium (i.e., all pertinent courses in both secondary and postsecondary institutions), and others have developed individual articulation agreements for each course within the consortium.

Appropriate curriculum design. Section 204 of the Perkins Act (U.S. Department of Education, 1998) requires that each Tech Prep education program have appropriate curriculum design:

> Consist of at least 2 years of secondary school preceding graduation and 2 years or more of higher education, or an apprenticeship program of at least 2 years following secondary instruction, with a common core of required proficiency in mathematics, science, reading, writing, communications, and technologies designed to lead to an associate's degree or a postsecondary certificate in a specific career field. (112 STAT. 3119)

Curriculum development. Section 204 of the Perkins Act (U.S. Department of Education, 1998) requires that each Tech Prep education program include the development of Tech Prep curricula for both secondary and postsecondary participants in the consortium that: (1) meet academic standards developed by the state, (2) link secondary schools and two-year postsecondary institutions, and if possible and practicable, four-year institutions of higher education, (3) use, if appropriate and available, work-based learning, and (4) use educational technology and distance learning.

In-service teacher training. Section 204 of the Perkins Act (U.S. Department of Education, 1998) requires that each Tech Prep education program include in-service training for teachers that:

(A) is designed to train vocational and technical teachers to effectively implement Tech Prep programs;

(B) provides for joint training for teachers in the Tech Prep consortium;

(C) is designed to ensure that teachers and administrators stay current with the needs, expectations, and methods of business and all aspects of an industry;

(D) focuses on training postsecondary education faculty in the use of contextual and applied curricula and instruction; and

(E) provides training in the use and application of technology. (112 STAT. 3119)

Counselor training. Section 204 of the Perkins Act (U. S. Department of Education, 1998) requires that Tech Prep education programs include training for counselors designed to enable them to more effectively:

(A) provide information to students regarding Tech Prep education programs;

(B) support student progress in completing Tech Prep programs;

(C) provide information on related employment opportunities;

(D) ensure that such students are placed in appropriate employment; and

(E) stay current with the needs, expectations, and methods of business and all aspects of an industry. (112 STATE. 3119)

Equal access for special populations. Section 204 of the Perkins Act requires that each Tech Prep education program " . . . provide equal access to the full range of technical preparation programs to individuals who are members of special populations, including the development of tech-prep program services appropriate to the needs of special populations" (U. S. Department of Education, 1998, 112 STAT. 3120).

Preparatory services. Section 204 of the Perkins Act requires that each Tech Prep education program provide for preparatory services that assist participants in tech-prep programs (U.S. Department of Education, 1998). Preparatory services include outreach to potential career and technical education students, career and personal counseling, and vocational assessment and testing. Preparatory services are provided to students not yet enrolled in Tech Prep. The delivery of services is before the 11th grade.

Perkins Four Core Indicators

The federal act requires evaluation of Tech Prep education programs. Under section 113 of the Carl D. Perkins Vocational and Technical Education Act of 1998 (U.S. Department of Education, 1998), the law states that each eligible agency shall identify its state plan for core indicators of performance for vocational and technical education that include, at a minimum, measures for each of the following:

(i) Student attainment of challenging State established academic, and vocational and technical skill proficiencies.

(ii) Student attainment of a secondary school diploma or its recognized equivalent, a proficiency credential in conjunction with a secondary school diploma, or a postsecondary degree or credential.

(iii) Placement in, retention in, and completion of, postsecondary education or advanced training, placement in military service, or placement or retention in employment.

(iv) Student participation in and completion of vocational and technical education programs that lead to nontraditional training and employment. (112 STAT. 3087)

The Office of Vocational and Adult Education (OVAE) has developed a core indicator framework to assist with the Perkins III requirements for performance reporting. Each state plan must identify performance measures for the core indicators (OVAE, 2000). A performance measure is defined as " . . . the type of outcome that is considered appropriate for monitoring" (Hoachlander, Levesque, & Rahn, 1992, p. 9). For each of the Perkins four core indicators, states must establish valid and reliable performance measures that specify levels of performance which can at a minimum “ . . . (I) be expressed in a percentage or numerical form, so as to be objective, quantifiable, and measurable, and (II) require the State to continually make progress toward improving the performance of vocational and technical education students” (U.S. Department of Education, 1998, 112 STATE. 3088).

The core indicator framework provides a guideline for all career and technical education programs. Because Tech Prep is a subset of career and technical education programs, not all of the core indicators may apply. Tech Prep evaluators select the core indicators and performance measures that are relevant to their Tech Prep education program and align them with any pertinent state Tech Prep efforts. The core indicators of performance require states to report secondary and postsecondary Tech Prep student outcomes data.

Student outcomes data is defined as changes that occur in individuals as a result of participation in an educational experience (Bragg, 1992). Student outcomes data can be collected for each of the Perkins III core indicators: (a) student attainment, (b) credential attainment, (c) placement and retention, and (d) participation in and completion of non-traditional programs. The student attainment indicator seeks to assess student attainment of challenging state established academic and vocational and technical skill proficiencies at both the secondary and postsecondary levels. Credential attainment seeks to assess student attainment of a secondary school diploma or its recognized equivalent, a proficiency credential in conjunction with a secondary diploma, or a postsecondary degree or credential. The placement and retention core indicator seeks to assess vocational and technical education student placement in, retention in, and completion of postsecondary education or advanced training, placement in military service, or placement or retention in employment. The participation in and completion of non-traditional programs assesses student participation in and completion of vocational and technical education programs that lead to non-traditional training and employment.

Methodology

An extensive literature review was conducted and conversations were held with individuals' known to have researched and published about Tech Prep. Conversations about Tech Prep, Tech Prep evaluation, and reporting of Tech Prep program and student outcomes data were obtained by telephone and on-site interviews between March and September 2000. Individuals who indicated in a 1997 *Local Tech Prep Implementation Follow-Up* survey (Bragg, 1997) that their consortium was at the "advanced stage" of Tech Prep evaluation were contacted by telephone between March and April 2000. Of the 63 individuals initially identified, 41 (65%) telephone interviews were conducted.

These individuals were asked questions related to Tech Prep evaluation efforts in their local consortium. Questions included: (a) What techniques are used to evaluated the Tech Prep education program?, (b) What types of data collection methods are used to collect Tech Prep program and students outcomes data?, and (c) Does your consortium have a Tech Prep evaluation plan? Individuals contacted were asked to send copies of Tech Prep evaluation documents that the consortium had developed. Fifteen (37%) individuals followed up and sent information or evaluation documents for the researcher to review.

The researcher reviewed 34 Perkins III 2000 – 2004 state plans at the Office of Vocational and Adult Education (OVAE) in Washington, DC in April 2000. The state plans were reviewed to gather examples of Perkins core indicator and program performance measures submitted by states that would assist with identifying student outcomes data. In addition, state plans were reviewed to identify evaluation plans, if any, submitted by states.

In addition to the telephone interviews and review of the Perkins III state plans, telephone contacts were made in April 2000 with state departments of education personnel and individuals who have conducted research related to Tech Prep. These individuals were asked to identify consortia in their state that were making progress in the area of Tech Prep evaluation. Seven Tech Prep consortia were identified and contacted for an on-site interview. Conversations were held with state Tech Prep directors and local Tech Prep consortium directors from Florida, Minnesota, Missouri (2), Montana, Oregon, and Wisconsin between May and August 2000. Questions included: (a) What is the structure of the Tech Prep consortium?, (b) What program outcomes are essential to determine program quality, effectiveness, and goal attainment?, (c) What student outcomes are essential to determine program quality, effectiveness, and goal attainment?, (d) What methods are used to collect data for the Tech Prep seven essential program elements?, and (e) What methods are used to collect data for the Perkins four core indicators? Information collected from these conversations and review of documents assisted with identifying a Tech Prep evaluation model and program and student outcomes data collection questions.

Tech Prep Evaluation Model

Some states have developed statewide Tech Prep evaluation models that provide a framework for evaluating Tech Prep for accountability and program improvement purposes. The Tech Prep evaluation efforts that follow describe current evaluation efforts in Connecticut, Florida, Illinois, Texas, and West Virginia. Complete copies of the evaluation documents described are available from the Measuring Tech Prep excellence: A practitioner’s guide to evaluation (Ruhland & Timms, 2001).

Connecticut has developed the *Tech Prep Success Analysis and Measurement Indicators* for state Tech Prep secondary and postsecondary participants (Connecticut State Department of Education, n.d.). The 11-item indicator analysis centers on various Tech Prep components. The analysis uses quantitative responses related to program and student outcomes. The indicators cover articulation agreements, 2 + 2 program design, student diversity, employer satisfaction, and student participation, completion, and employment.

Florida’s Tech Prep Consortia Annual Report has been designed to enhance the quality, effectiveness, and achievement of Tech Prep goals for each consortium. Beginning January 1, 1993, Florida International University was granted a project entitled Performance-Based Project for the Development of a Florida Statewide Plan for Evaluation (Hammonds, 1995). The project’s activities included the planning, development, and implementation of a statewide plan to evaluate Tech Prep activities. The review included collecting data to assist with the preparation of an annual report from each consortium. The annual report provides information on a consortium’s accomplishments and identifies measurable benchmarks that can be used for future comparisons.

In Illinois, prior to 1998, local consortia and the Illinois State Board of Education (ISBE) carried out evaluation of Tech Prep education programs, but these activities typically addressed a distinct aspect of Tech Prep rather than an entire program. To address this void, the Tech Prep Evaluation System for Illinois (TPESI) was developed through an initiative involving the Office of Community College Research and Leadership (OCCRL) at the University of Illinois at Urbana-Champaign (UIUC), the ISBE, and the Illinois Community College Board (ICCB) (Bragg, 1998). Goals that guide the TPESI system and provide a rationale for Tech Prep evaluation include: (1) describe the status of Tech Prep implementation in Illinois, (2) identify participants in Tech Prep and describe how the participation of various Tech Prep student groups changes over time, (3) identify the benefits (outcomes) of Tech Prep for students, especially outcomes linked to student learning, (4) identify the benefits (outcomes) of Tech Prep for other stakeholder groups, and (5) discern strategies that support the continuous improvement of Tech Prep within consortia statewide and at the state level.

For each secondary school and two-year college site visit, team members rate the implementation stage and quality of the eight Tech Prep essential elements and the eight Tech Prep supporting elements as part of the School Assessment Form. The eight Tech Prep essential elements were (a) 2+2 program that leads to associate degree, (b) articulation, (c) curriculum development, (d) inservice training for teachers, (e) inservice training for counselors, (f) equal access for special populations, (g) preparatory services, and (h) work-based learning experiences. The eight Tech Prep supporting elements were: (a) leadership, organization and administrative support, (b) parental support, (c) business/labor/community involvement, (d) transition of students to postsecondary education, (e) secondary/postsecondary collaboration, (f) identification and accurate reporting of Tech Prep students, (g) evaluation and program improvement, and (h) integrated, contextual strategies. The Consortium Assessment Form assesses each essential element and supporting element for the consortium overall. This form includes (a) stage of implementation, (b) quality of element, and (c) additional comments and recommendations. A matrix is provided for each element that includes a description for program and student outcome measures.

Texas developed a site-based peer review process to assess each consortium in a range of areas and sub areas (Texas Higher Education Coordinating Board, 2000). Review areas include program, instruction, counseling, professional development, marketing, budgeting, planning, student success, and evaluation. For each sub area, criteria are provided along with measurement statements, core standard descriptions, and recommended resources. Reviewers must assess whether the consortium does not meet, meets, or exceeds the standard, and they must provide explanatory comments.

West Virginia's Tech Prep standards are based on 20 "STARS" (Strategies That Advance Reform in West Virginia Schools) that cover areas including curricula, stakeholder support, marketing, and assessment measures (West Virginia Department of Education, n.d.). Each of the STARS identifies specific performance concepts, associated documentation data, and suggested strategies to achieve STARS standards. The documentation data section provides a list of items that consortium members can review to identify standards. All of the STARS have been compared with the National Association Tech Prep Leadership's (NATPL) quality indicators and Perkins III four core indicators. The STARS are rated based on the presence or absence of STARS documentation data. Consortia conduct a self-assessment of the STARS each year and submit the findings to the state Tech Prep director. Once every three years, an on-site technical review by the state Tech Prep director and a team of local Tech Prep coordinators follows this self-assessment.

The management-oriented evaluation model is recommended for evaluating Tech Prep education programs. The rationale for recommending the management-oriented model is that "evaluative information is an essential part of good decision making and that the evaluator can be most effective by serving administrators, policy makers, boards, practitioners, and others who need good evaluative information" (Worthen, et al., 1997, p. 97). In a management-oriented approach, Tech Prep education programs can be evaluated following a four-step approach. An overview of the four-step approach is provided in Table 2 (Dutton, et al., 1994; Fleishman, 1995; Levesque, Bradby, Rossi, & Teitelbaum, 1998). It is important to reiterate that when evaluating Tech Prep education programs, both program and student outcomes data should be collected. The four-step approach to planning and conducting an evaluation provides an evaluation model to state and local Tech Prep personnel to begin the process of evaluating Tech Prep education programs.

The management-oriented evaluation model is useful to guide program improvement. Each year when local Tech Prep consortia prepare their local plans, information obtained from the Tech Prep program evaluation can identify new activities and modify existing activities. This process will also assist with the allocation of funds to support both state and local Tech Prep activities. "This evaluation approach has also been used for accountability purposes" (Worthen, et al., 1997, p. 103). Using the management-oriented evaluation model will provide the data in response to Perkins III accountability requirements.

Tech Prep Program Outcomes Data

Each consortium receiving Perkins funding is required to submit as part of its state plan a five-year plan for the development and implementation of Tech Prep education programs. These plans are expected to report on the seven essential program elements required of Tech Prep education programs. The Perkins Tech Prep seven program elements are: (a) articulation agreements, (b) appropriate curriculum design, (c) curriculum development, (d) in-service teacher training, (e) counselor training, (f) equal access for special populations, and (g) preparatory services.

Information obtained from conversations with Tech Prep personnel and review of Tech Prep documents assisted with identifying Tech Prep program outcomes data collection questions. The following list of questions serves as a beginning step for local consortia to assist with Tech Prep program outcomes data collection efforts. Those responsible for the evaluation of Tech Prep education programs can modify any of the questions, and develop additional questions specific to their local Tech Prep program goals and evaluation needs as outlined in their local plan.

Table 2
A Four-step Approach to Planning and Conducting an Evaluation

STEP 1: Identify the objectives of the evaluation.	▪ identify what needs to be measured (the specific objective) ▪ define the participants (e.g. student, concentrator, completer)
STEP 2: Choose the evaluation method.	▪ decide how to measure (measurement approach and data sources) ▪ choose what these data will be measured against
STEP 3: Collect the data.	▪ decide who will collect the data ▪ determine how the data will be recorded ▪ specify when the data will be collected (frequency and timeline) ▪ collect both baseline data and ongoing data
STEP 4: Analyze and communicate the results.	▪ categorize and code data ▪ find meaning and interpret the data ▪ look for trends and underlying causes ▪ summarize the information into key points ▪ make recommendations and plan for the future

Articulation agreements. Suggested Tech Prep data collection questions to evaluate articulation agreements:

1. What process is used for developing articulation agreements?
2. What evidence exists that articulation agreements reflect a minimum of a 2 + 2 program of study for each Tech Prep career pathway?
3. What is the process to evaluate articulation agreements?
4. What evidence exists that articulation agreements are being used?

Appropriate curriculum design. Suggested Tech Prep data collection questions to evaluate curriculum design:

1. How is the Tech Prep education program structured (e.g., 2 + 2, 2 + 2+ 2, or 4 + 2)?

2. What is the percent increase in the number of students completing a two-year college program within three years of initial entry compared to the previous year's baseline data?
3. How is the curriculum designed to ensure a common core of required proficiencies in mathematics, science, reading, writing, communications, and technologies that leads to an associate's degree or two-year certificate in a specific career field?
4. What is the process to evaluate curriculum design?

Curriculum development. Suggested Tech Prep data collection questions to evaluate curriculum development:

1. Is there a decrease in the number of students in remedial courses who enroll in a two-year college program the semester following high school graduation compared to the previous year's baseline data?
2. Is there an increase in the percentage of students enrolled in work-based learning experiences linked to industry skills standards and state-issued skill certificates compared to the previous year's baseline data?
3. How are secondary faculty and two- and four-year college faculty working together to plan, develop, and implement a Tech Prep education program of study?
4. How are career exploration and planning courses made available to students?

In-service teacher training. Suggested Tech Prep data collection questions to evaluate in-service teacher training:

1. What have teachers learned as a result of participating in staff development activities?
2. How do new or substantially revised academic courses emphasize contextual learning?
3. What internship opportunities are provided to inform teachers and administrators of industry work sites and labor force expectations?
4. What is the process to evaluate in-service teacher training activities?

Counselor training. Suggested Tech Prep data collection questions to evaluate counselor training:

1. What staff development activities have been provided to counselors to assist with the counseling and advising of Tech Prep students in secondary schools and two-year colleges?
2. Is there an increase in the number of students enrolling in a two-year college the semester following high school graduation compared to the previous year's enrollment in two-year colleges?

3. What are the indicators to show an increase in Tech Prep awareness among high school and two-year college counselors?
4. Do students in grades 9 to 12 prepare a written career plan that outlines high school work and/or high school to two- or four-year education plans leading to future employment?

Equal access to special populations. Suggested Tech Prep data collection questions to evaluate equal access for special populations:

1. How do promotional items for Tech Prep marketing reflect educational equity for special populations?
2. How is Tech Prep serving special populations?
3. Describe the Tech Prep experiences that have benefited special populations in secondary schools and two-year colleges.
4. How are services provided to allow equal access for special populations?

Preparatory services. Suggested Tech Prep data collection questions to evaluate preparatory services:

1. What types of services does the consortium provide to assist students in secondary schools in the selection of or preparation for appropriate Tech Prep education program of study?
2. Does the consortium have a Tech Prep marketing plan? How is the marketing plan implemented and evaluated?
3. What is the process to evaluate preparatory services?
4. What are the promotional activities for students in grades 8 to 12, parents, businesses, and community members?

Tech Prep Student Outcomes Data

In the literature review, the Perkins III four core indicators accountability requirements were described. The four core indicators are: (a) student attainment, (b) credential attainment, (c) placement and retention, and (d) participation in and completion of non-traditional programs. Based upon the conversations with Tech Prep personnel and review of Tech Prep documents, the following student outcomes data collection questions are suggested. For each of the examples suggested, the quantifiable measure and/or timeline are not included. These have been left blank, and data would be completed based upon a state or local consortium's benchmark or standards. The "S" reports secondary student outcomes data, and the "P" reports postsecondary student outcomes data. These examples demonstrate different approaches to measuring the Perkins four core indicators. Each example specifies (a) a quantifiable measure (e.g., percentage, number), (b) a timeline (e.g., two semesters, six months, one year), and (c) the sample population (e.g., Tech Prep student, completer, concentrator). The student outcomes data can be analyzed, summarized, and submitted as part of the state plan for vocational education and the reporting of Perkins III accountability requirements.

Core indicator 1 student attainment. Suggested Tech Prep data collection questions to evaluate student attainment:

1S1. ___ percent of Tech Prep concentrators will complete the high school graduation requirements.

1S2. The Tech Prep student score on a licensure or certification examination, for those fields in which licensure or certification is required, industry-endorsed competency examination, or a state-recognized test will increase by ___ percent by ___ (insert year).

1P1. ___ percent of matriculated postsecondary Tech Prep students who enrolled in the fall of each year in academic and career and technical courses will successfully complete the courses as measured by credits earned at the end of the semester.

2P2. ___ percent of postsecondary Tech Prep students will have attained a degree, a certificate, apprenticeship, or industry certification two years following enrollment in the degree program.

Core indicator 2 credential attainment. Suggested Tech Prep data collection questions to evaluate credential attainment:

2S1. The rate at which secondary Tech Prep concentrators become completers will be ___ percent for _____(insert year) and ___ percent over four years.

2S2. ___ percent of Tech Prep students who graduate with a high school diploma will equal or exceed the statewide graduation rate each year.

2P1. ___ percent of the postsecondary Tech Prep students will obtain an associate degree or technical certificate within three years of enrolling in the degree program.

2P1. The rate at which postsecondary Tech Prep concentrators become completers will be ___ percent for ___ (insert year) and ___ percent over four years.

Core indicator 3 placement and retention. Suggested Tech Prep data collection questions to evaluate placement and retention:

3S1. Within one year of high school graduation, at least ___ percent of Tech Prep concentrators will matriculate into a postsecondary education program or registered apprenticeship.

3S2. ___ percent of Tech Prep concentrators who respond to the follow-up survey will still be engaged in postsecondary education and/or employment within one year of graduation.

3P1. The number of Tech Prep students who obtained employment directly related to their postsecondary degree has increased by ___ percent.

3P2. ___ percent of postsecondary completers (two-year) articulated credits to a four-year institution and are pursuing baccalaureate degrees.

Core indicator 4 participation in and completion of non-traditional programs. Suggested Tech Prep data collection questions to evaluate participation in and completion of non-traditional program:

4S1. At least ___ percent of Tech Prep students in underrepresented gender groups will be enrolled in courses that have been identified as leading to nontraditional employment for that gender.

4S2. The number of nontraditional Tech Prep students who enrolled in and completed a career and technical education program within industry clusters will be ___.

4P1. ___ percent of postsecondary Tech Prep students participating in a nontraditional career and technical education program will be from underrepresented gender groups.

4P2. The percentage of postsecondary Tech Prep students by gender graduating from nontraditional degree programs during the most recent academic year will increase by ____ percent.

Conclusions

As with any new initiative, those promoting change must be careful to educate and gain the commitment and involvement of stakeholders. Including stakeholders in the evaluation of the Tech Prep education program can facilitate this. As the evaluation process begins, communication should occur frequently among stakeholders to allow for questions to be asked and information to be distributed (Dutton, et al., 1994; Fleishman, 1995; Levesque, et al., 1998).

Due to the variability of state and local Tech Prep education programs, the evaluation model selected should meet the reporting requirements of the local and/or state plan. This paper recommends the management-oriented evaluation model to evaluate Tech Prep education programs. This model involves four steps: (1) identifying the objectives of the Tech Prep program evaluation, (2) choosing the evaluation method, (3) collecting the data, and (4) analyzing and communicating results. With the increased accountability requirements at the federal level, this model provides the information that policymakers will need to support the reauthorization of Perkins III.

Those responsible for Tech Prep evaluation should not anticipate undertaking a major evaluation effort the first year, but rather focus on two or three evaluation objectives that will provide data related to the Tech Prep program goals. These objectives will lead to additional objectives that will assist with evaluation occurring at regular intervals throughout the program (Dutton, et al., 1994). After the Tech Prep evaluation is completed, it is important to review the results, identify future Tech Prep education program plans, and set new goals for program improvement. Tech Prep consortia should build systems and structures to support and promote continuous improvement within the Tech Prep education program. State leadership is critical if we are to optimize the return on investments of federal funds and to support the reauthorization of Perkins III.

Those evaluating Tech Prep education programs will continue to face challenges. The lack of a common definition of a secondary and postsecondary Tech Prep student, concentrator and completer, continues to result in data not being useful. Efforts need to continue to support common definitions for data collection and reporting efforts. If all states were required to use common definitions, Tech Prep data would be reported, analyzed, and summarized from a national perspective. This would eliminate one of the criticisms we continue to hear from the federal level, that data collected does not represent a national perspective.

The research summarizing efforts to collect and report Tech Prep program and student outcomes data as reported in this paper has been minimal. States report the communication between secondary and postsecondary schools is minimal, and reporting of Tech Prep students is often lost in matriculation. Further the reported lack of data collection systems at the postsecondary level has resulted in minimal data collected to report the impact of program and student outcomes data. State Tech Prep directors and local Tech Prep coordinators need to begin by identifying what data needs to be collected to report program and student outcomes data. Discussions need to take place with those who can assist with the data collection process. An initial step may be in changes to the graduate follow–up survey to include questions related to Tech Prep program and student outcomes data questions suggested in this paper. Agreeing upon at least one Tech Prep data collection question, and deciding how to collect the data, is a major step in beginning the Tech Prep evaluation process. If all states would take this approach, reporting of Tech Prep data on a national level may provide the information policymakers would need to support reauthorization of Perkins III to include continued funding for Tech Prep education programs.

References

Baldrige National Quality Program. (n.d.). *Education criteria for performance excellence*. Retrieved April 17, 2003, from http://www.quality.nist.gov/education_criteria.htm

Barak, R. J., & Breier, B. E. (1990). *Successful program review*. San Francisco: Jossey-Bass.

Barnett, E. (2002). Counting Tech Prep students. *Techniques, 77*(1), 60-61.

Boulmetis, J., & Dutwin, P. (2000). *The ABCs of evaluation: Timeless techniques for program and project managers.* San Francisco: Jossey-Bass.

Bragg, D. D. (1992). *Alternative approaches to outcomes assessment for postsecondary vocational education.* (MDS 239). Berkeley: University of California at Berkeley, National Center for Research in Vocational Education.

Bragg, D. D. (1997). *Educator, student, and employer priorities for Tech Prep student outcomes.* (MDS 790). Berkeley: University of California at Berkeley, National Center for Research in Vocational Education.

Bragg, D. D. (1998). *Tech Prep evaluation system for Illinois (TPESI).* Champaign, IL: University of Illinois-Urbana/Champaign.

Bragg, D. D. (2001). *Promising outcomes for Tech Prep participants in eight local consortia: A summary of initial results.* St. Paul: University of Minnesota, National Research Center for Career and Technical Education.

Bragg, D. D., Puckett, P. A., Reger, W. M., IV, Thomas, H. S., Ortman, J., & Dornsife, C. J. (1997). *Tech Prep/School-to-work partnerships: More trends and challenges*. (MDS 1078). Berkeley: University of California at Berkeley, National Center for Research in Vocational Education.

Brown, J. M., Pucel, D., Twohig, C., Semler, S., & Kuchinke, P. (1998). Minnesota's Tech Prep outcome evaluation model. *Journal of Industrial Teacher Education, 35*(3), 44-66.

Connecticut State Department of Education. (n.d.). *Tech Prep success analysis and measurement indicators.* Middleton, CT: Author.

Connell, T. J., & Mason, S. A. (1995). *School to work transition: Issues and strategies for evaluation and program improvement.* Paper presented at the annual meeting of the American Educational Research Association, San Francisco. (ERIC Document Reproduction Service No. ED 383 905).

Conrad, C. F., & Wilson, R. F. (1985). *Academic program review: Institutional approaches, expectations, and controversies.* ASHE – ERIC Higher Education Report No. 5. Washington, DC: Association for the Study of Higher Education.

Dixon, G., & Swiler, J. (Eds.). (1990). *Total quality handbook: The executive guide to the new way of doing business.* Minneapolis: Lakewood.

Dutton, M., Hammons, F., Hudis, P., & Owens, T. (1994). *Evaluating your Tech Prep program*. Waco, TX: Center for Occupational Research and Development.

Fleishman, H. L. (1995). *Is it working? Self-help guide for evaluating vocational and adult education programs.* Washington, DC: Office of Vocational and Adult Education.

Hammons, F. T. (1995). *Florida Tech Prep evaluation model*. Tallahassee: Florida Department of Education. (Document Request Number GE 334 BK 94). Available from the World Wide Web: http://www.fiu.edu/~xiwc/techprep_eval.htm.

Hershey, A. M., Silverberg, M. K., Owens, T., & Hulsey, L. K. (1998). *Focus for the future: The final report of the national Tech Prep evaluation*. Princeton, NJ: Mathematica Policy Research.

Hitchcock, G., & Hughes, D. (1989). *Research and the teacher.* New York: Routledge.

Hoachlander, E. G., Levesque, K., & Rahn, M. L. (1992). *Accountability for vocational education: A practitioner's guide*. (MDS-407). Berkeley: University of California at Berkeley, National Center for Research in Vocational Education.

Levesque, K., Bradby, D., Rossi, K., & Teitelbaum, P. (1998). *At your fingertips: Using everyday data to improve schools*. Walnut Grove, CA: George Lithograph.

Logan, J. P. (1999). *Kentucky's Tech Prep evaluation system: A five-year review*. Paper presented at the annual meeting of the American Educational Research Association, Montreal. (ERIC Document Reproduction Service No. ED 431 098).

National Association of Tech Prep Leadership. (1999). *Tech Prep program quality indicators*. author.

National Association of Tech Prep Leadership. (2003). *Tech Prep program quality indicators.* Author.

Office of Vocational and Adult Education. (2000). *Core indicator framework*. Washington, DC: U.S. Department of Education.

Pucel, D. J., Brown, J. M., & Kuchinke, K. P. (1996). Evaluating and improving Tech Prep: Development, validation, and results of the Minnesota self-assessment model. *Journal of Vocational Education Research, 21*(2), 79-106.

Ross, J. E. (1993). *Total quality management: Text, cases and readings*. Delray Beach, FL: St Lucie.

Ruhland, S. K., & Timms, D. M. (2001). *Measuring Tech Prep excellence: A practitioner's guide to evaluation*. St. Paul, MN: The National Research Center for Career and Technical Education.

Ruhland, S. K., Custer, R. L., & Stewart, B. R. (1995, April). *Evolving a model for evaluating Tech Prep implementation.* Paper presented at the annual meeting of the American Educational Research Association meeting, San Francisco. (ERIC Document Reproduction Service No. ED 384 650).

Schroeder, D. E. (2000). *Local school implementation committee Tech Prep action plan.* Hutchinson, MN: Mid-Minnesota School-to-Careers/Tech Prep Consortium.

Silverberg, M. K., Hulsey, L. K., & Hershey, A. M. (1997). *Heading students towards career horizons: Tech Prep implementation progress, 1993-1995.* Washington, DC: U.S. Department of Education.

Texas Higher Education Coordinating Board. (2000). *Tech Prep consortium site evaluation.* Austin, TX: Community and Technical Colleges Division.

U.S. Department of Education. (1998). *The Carl D. Perkins Vocational and Technical Education Act, Public Law 105–332*. Retrieved April 17, 2003, from http:frwebgate.access.gpo.gov/cgi-Bin/getdoc.cgi?dbname=105_cong_public_laws&docid=f:pub1332.105.pdf

U. S. Department of Education. (n.d.). *The Carl D. Perkins Vocational and Technical Education Act, Public Law 105-332*. Retrieved April 17, 2003, from http://www.ed.gov/offices/OVAE/CTE/perkins.html

West Virginia Department of Education. (n.d.). *West Virginia's "Stars".* Charleston, WV: Author.

Worthen, B. R., Sanders, J. R., & Fitzpatrick, J. L. (1997). *Program evaluation alternative approaches and practical guidelines* (2nd edition). New York: Longman.

Notes

This article has been extracted from "Measuring Tech Prep Excellence: A Practitioner's Guide to Evaluation" as part of the program of work of the National Research Center for Career and Technical Education at the University of Minnesota funded by the U.S. Department of Education, Office of Vocational and Adult Education.

SHEILA K. RUHLAND is Assistant Professor in The Department of Work, Community, and Family Education, University of Minnesota, 420 Vocational and Technical Education Building, 1954 Buford Avenue, St. Paul, MN 55108. e-mail: ruhla006@umn.edu

Journal of Vocational Education Research, 28(1), 59-84.

What Do We Know About the Effects of School-to-Work? A Case Study of Michigan

David Neumark
Public Policy Institute of California
Michigan State University
National Bureau of Economic Research

Ann Allen
Michigan State University

Abstract

As states continue to develop school-to-work programs following the federal School-to-Work Opportunities Act (STWOA), a critical question regards the causal effects of school-to-work programs in achieving their goals. Rather than relying on published studies that would appear only with long lags, and which would be unlikely to focus on particular local programs that might nonetheless be effective, this paper adopts a case study approach to assembling evidence on the effectiveness of school-to-work in a particular state (Michigan) that has been at the forefront of school-to-work efforts. We set out to obtain all available evidence and information of the effectiveness of school-to-work in Michigan, based on a review of available studies often at a very local level, as well as interviews with academic and career educators and state representatives involved in school-to-work. This evidence and information is analyzed from the perspective of whether it establishes beneficial causal effects of school-to-work on student outcomes. Our case study establishes that Michigan has developed a comprehensive career preparation system that reaches many students. Nonetheless, a critical analysis of the evaluation efforts to date indicates a serious shortfall in these efforts, and an absence of solid evidence regarding causal effects of school-to-work in the handful of evaluations that have been carried out.

The 1994 Federal School-to-Work Opportunities Act (STWOA) provided more than $1.5 billion to support increased career preparation activities in the country's public schools. Congress passed the STWOA in response to research by scholars and educators suggesting that schools were inadequately preparing students for an increasingly complex world of work, both in terms of teaching skills and behaviors inschool that would be valued in the labor market, and providing the information necessary to assist students in making a successful transition from school into a productive and remunerative career. The overall perception of the problem was well-characterized in a report by the U.S. Office of Technology Assessment describing the existing system as producing youths who were " . . . unmotivated in school and spend years bouncing from one low-paying job to another" (1995, p. 3). The goals of the STWOA were therefore to help young people develop the skills needed in the workforce and make better connections to careers through school-to-work transition systems. Spurred in part by the STWOA, many states have implemented extensive school-to-work systems, generally entailing close cooperation with schools in the implementation of curriculum changes, and partnerships with private business and government bodies.

A natural and indeed compelling question to ask at this juncture is whether school-to-work programs have been effective in achieving their goals. In particular, the critical question is whether school-to-work programs have had causal effects on participants that point to success in achieving the goals of the STWOA. This question has come to the fore in some recent work. In particular, Mathematica Research, Inc., completed a national school-to-work study in 1999 (Hershey, Silverberg, & Haimson, 1999). However, the Mathematica study does not assess the causal relationship between school-to-work and student outcomes, but rather provides a national picture of school-to-work initiatives. And a recent survey of published academic research on school-to-work across the U.S., by the Institution on Education and the Economy, generally supports the claim that little progress has been made in estimating the causal effects of school-to-work programs (Hughes, Hamilton, & Ivry, 2001).

This paper takes a different approach to assembling evidence on the effectiveness of school-to-work. In particular, because state and local governmental units are at the forefront of school-to-work efforts, and because much of the "action" with respect to school-to-work is new, the most up-to-date evidence on the effects of school-to-work is unlikely to have yet appeared in academic journals–if indeed it will ever do so–and is perhaps most likely to still be in the hands of practitioners rather than researchers. The strategy chosen, therefore, was to undertake a case study of one state that has been at the forefront of school-to-work efforts. Specifically, the study focuses on Michigan, which was one of the first eight states to receive federal money from the STWOA in 1994. STWOA funding was set to end in 1999, but Michigan applied for a grant extension that continued through September 2001. The current incarnation of school-to-work in Michigan is the Career Preparation System, the goals of which parallel those of the STWOA.

We set out to obtain all available evidence and information regarding the effectiveness of school-to-work in Michigan, to determine what can be established at this juncture concerning the impact of Michigan's school-to-work efforts on youth education and employment and early career decisions of youths. This evidence and information was gathered from a review of available studies and data, often from the local governmental level, and from interviews with academic and career educators and government representatives involved in school-to-work. In particular, we interviewed representatives of the state's Educational Advisory Groups, including

Intermediate School District superintendents and staff, and state school-to-work administrators. After summarizing the development of school-to-work in Michigan, and describing the current institutional structure, we present an exhaustive summary and, most importantly, a critical analysis of the available evidence on the effectiveness of Michigan's school-to-work programs, from the perspective of whether it establishes beneficial causal effects of school-to-work on students.

Our case study of school-to-work in Michigan does establish that the STWOA has pushed Michigan forward toward the development of a comprehensive career preparation system, creating an impressive structure for the implementation of school-to-work, and one that is apparently reaching many students. Furthermore, state and local districts are starting to recognize and perhaps act on the need for ongoing assessment of program outcomes–that is, assessment of the extent to which school-to-work transitions are improved relative to what would have occurred in the absence of this system. Nonetheless, our current state of knowledge regarding the causal effects of school-to-work in Michigan is extremely limited, as we found only a smattering of studies estimating such effects, and virtually none employing standard social scientific methods of program evaluation. At this point, therefore, the combined evidence from this case study and the national surveys cited above does not provide a strong empirical case for concluding that school-to-work programs achieve their intended goals. Furthermore, given the absence of such an empirical case, we would argue that investment in research that endeavors to establish causal effects of school-to-work would play a highly constructive role in shaping the further development of school-to-work systems.

While the potential gains from our research strategy have already been noted, it also has an important limitation. Specifically, it is limited to a single state, although one that developed an extensive school-to-work system under the STWOA. As a consequence, the conclusion that this particular state has little evidence on the causal effects of its school-to-work programs does not generalize to other states. We believe that studies using a similar strategy to assess the evidence on the effectiveness of school-to-work in other states would be valuable, although it would be useful to use other sources to try to identify states in which more rigorous evaluations are purported to have been used or in which more suitable data have been collected, in order to narrow the set of states meriting such close scrutiny.

The Federal School-to-Work Opportunities Act and School-to-Work in Michigan

The Federal School-to-Work Opportunities Act

The 1994 Federal School-to-Work Opportunities Act (STWOA) provided more than $1.5 billion in grants to states and local partnerships to support increased career preparation activities in the country's public schools (Hershey et al., 1999). According to a report by the U.S. Office of Technology Assessment (1995), Congress passed the STWOA in response to research by scholars and educators that highlighted three areas of concern for public education. These were: (1) a lack of connection between school and work that led many youths to be unmotivated in school and to experience subsequent difficulty moving out of low-wage jobs; (2) youths completing school with insufficient skills needed for the labor market; and (3) increasing labor market demands for complex thinking, close teamwork, and the ability to learn on the job. The STWOA aimed to help young people develop the skills needed in the workforce and make better connections to careers through school-to-work transition systems, which fostered partnerships among schools, employers, and others (Office of Technology Assessment, 1995). Specifically, the STWOA set out to increase: (1) school-based initiatives such as career links to academic curriculum, and career awareness activities; (2) work-based activities such as job shadowing, internships, and apprenticeships; and (3) connecting activities, such as the development of partnerships with employers and post-secondary institutions. A more detailed summary of the STWOA is provided in Figure 1.

School-to-Work in Michigan

Michigan was one of the first eight states to receive federal money from the STWOA in 1994. STWOA funding was set to end in 1999, but Michigan applied for a grant extension that continued through September 2001. From 1994 to 2001, Michigan received more than $50 million of federal STWOA funds to develop and support local and state-wide school-to-work initiatives (Levin, 1999).

Figure 2 provides a time-line for the development of school-to-work in Michigan. Before the STWOA, Michigan schools were providing career and technical education through such programs as cooperative education and vocational education. But it was the state's tech prep initiative, supported through the Carl Perkins Amendments of 1990 (Bailey, 1995; Urquiola et al., 1997), which attempted to move career and technical education from isolated programs to a school-reform initiative–improving educational outcomes for students through more relevant, contextual learning, and stronger connections to employers and careers (Jacobs & Teahen, 1998).

Cooperative and Vocational Education and Tech Prep

Tech prep, as a federal program, aimed to encourage the development of programs from high school to college in specific occupational areas (Bailey, 1995). In a report on Michigan's tech prep initiatives, Jacobs and Teahen (1998) quoted the 1988 Executive Summary of the Tech Prep Task Force to define "tech prep initiatives" as associate degree programs made up of partnerships among school districts, community colleges, and employers to prepare youths and adults for entry into technical career fields (Tech Prep Task Force, 1988, p. 1).

Figure 1. Summary of the School-to-Work Opportunities Act

State and local school-to-work transition systems are to be planned and developed by partnerships of school staff, business leaders, labor representatives, and other interested parties. Governors are given considerable discretion in structuring and administering the partnerships for the state systems. At the local level, the lead entities may be schools, colleges, nonprofit organizations, and chambers of commerce.

STWOA encourages development of school-to-work transition systems that coordinate career orientation, academic and occupational education, high school and postsecondary schooling, work-based learning, and skill credentialing. The legislation specifically divides these elements into the following three components:

♦ School-based Learning

- Academic instruction in high school that meets the state standards for all students and the applicable standards of the National Education Goals.
- Career exploration and counseling, beginning no later than 7th grade for interested students.
- Initial selection by interested students of a career major beginning no later than the 11th grade.
- Instruction that integrates academic and occupational learning.
- Arrangements to coordinate high school and postsecondary education and training.
- Regularly scheduled evaluations of students' personal goals, progress, and needed learning opportunities.

♦ Work-based Learning

- Job training and work experiences aimed at developing pre-employment skills and employment skills at progressively higher levels, and leading to the award of skill certificates.
- Broad instruction in all aspects of industry to the extent practical.
- Workplace mentoring.

♦ Connecting Activities

- Activities to encourage employers to participate and to aid them in doing so.
- Assistance in the integration of school-based and work-based learning, and of academic and occupational instruction.
- Matching of students with the work-based learning opportunities offered by employers.
- Liaison among the students, schools, employers, and parents.
- Assistance for graduates in finding appropriate jobs, getting additional job training, or pursuing further education.
- Monitoring of participants' progress after they complete the program.
- Linkage of these youth development activities with employer and industry strategies for upgrading the skills of incumbent workers.

Source: Office of Technology Assessment (1995).

Figure 2. Time-line of Development of School-to-Work in Michigan

Coop/Vocational Education System	Perkins Amendment Tech Prep Reform	STWOA	Career Preparation	
1960s____________	1990______________	1994_________	1997________	2004[a]

[a]A report by the Michigan Department of Career Development (2000) indicates a commitment by nearly 90 percent of state school districts to develop career pathway programs and establish Education Development Plans for secondary students.

Jacobs and Teahen found that tech prep set the stage for career preparation as educational reform. They pointed to four contributions tech prep made to educational reform in Michigan including: (1) encouraging the development of courses that connected critical thinking skills to workplace skills; (2) the creation of tech prep consortia, made up of secondary and postsecondary educators and business and industry representatives, which became a vehicle through which business and labor representatives could more directly affect secondary and postsecondary education; (3) bringing together representatives of secondary and postsecondary institutions for meaningful dialogue; and (4) developing new personnel roles in the education system, including work as liaisons between schools and employers. Jacobs and Teahen cited reports from the Michigan Department of Education indicating that tech prep programs in Michigan were engaging 50 percent of all 12th graders in the state, and local consortia were developing activities and programs that reached not only high school, community college, and business representatives, but K-12 educators and administrators as well. Tech prep, then, began to make some inroads in changing the educational system to attempt to better connect students to careers.

Yet one of the issues tech prep coordinators faced was gaining parental support. Jacobs and Teahen (1998) contended there was a sense among vocational educators that parents believe all children should go to college, thereby perpetuating the belief that tech prep is not college preparatory curriculum. Stemming from this, presumably, their study found little evidence of parental support for tech prep initiatives. (In partial contrast, a 1995 survey of community response to the school-to-work initiative in Michigan (EPIC-MRA, 1995) indicated broad-based community support for a school-to-work system in the state.) In particular, Jacobs and Teahen found that parents and students were represented on 58 percent and 50 percent of consortia boards, respectively. However, activities involving parents were found to be mostly marketing programs intended to convince parents of the value of tech prep initiatives, and the authors found no state or local parent organizations that played a significant role in the tech prep initiative. This led them to conclude that tech prep could not be institutionalized without parental support. In addition, state and national studies of tech prep indicate that little data exist exploring how the initiatives affect student outcomes (Jacobs & Teahen, 1998; Urquiola, et al., 1997).

One of the challenges to tech prep noted by Jacobs and Teahen was that the STWOA came on the scene as the tech prep initiatives were getting underway, causing some confusion about the goals and roles of the two systems. However, they found that the majority of the state's tech prep directors aligned the tech prep programs with the STWOA–even though school-to-work was funded and governed from a different state agency than tech prep–resulting in more than 80 percent of the state's tech prep programs receiving funding from the STWOA (Jacobs & Teahen, 1998). (While the tech prep initiative was initially administered out of the Michigan Department of Education, the STWOA was administered by the Michigan Works! agencies and overseen by workforce development boards–decision-making boards with a majority of citizens from the private sector (i.e., employers) that are responsible for the state's workforce development programs.) In many cases, the people involved in the tech prep consortia were the same people leading the STWOA initiatives. Yet the STWOA was seen to have broader implications than tech prep programs (Urquiola et al., 1997; Bailey, 1995), in part because it encompassed career development that went beyond the two-year college.

The STWOA in Michigan

The STWOA called for schools to establish links with two-year and four-year postsecondary institutions to better help students prepare for careers and the postsecondary education that leads to those careers. The 1994 school-to-work initiatives in Michigan focused on building a K-12 system that better supported students' preparation for careers through the three types of activities articulated by the federal initiative: school-based learning; work-based learning; and connecting activities (Bailey, 1995; Office of Technology Assessment, 1995; Urquiola et al., 1997). According to the state's original vision for a school-to-work system, school-based learning included career awareness, career exploration and counseling, challenging academic standards, skill standards, a coherent multi-year sequence of instruction, and regularly-scheduled evaluations of progress. Work-based learning included a planned program of job training and experiences relevant to a student's career and leading to the award of a skill certificate, paid work experience, workplace mentoring, and instruction in general workplace competencies. Connecting activities included school courses that taught knowledge and skills used at work, helped parents become knowledgeable about school and work, and matched students with employers' work-based learning opportunities (personal communication with J. Mahoney, coordinator of tech prep and career education for the state in the Office of Career and Technical Preparation, Michigan Department of Career Development, October 2001).

Like tech prep, school-to-work in Michigan struggled to find broad-based support. J. Mahoney (personal communication, October 2001), reported that one struggle was communicating the mission of the initiative to parents and to some educators who feared that school-to-work was an occupational program and did not promote or support college-bound programs, high academic achievement, or professional careers. In addition, funds for school-to-work in Michigan were funneled through the local Workforce Development Boards–former Private Industry Councils reorganized by the state in 1996 to oversee the planning and delivery of service for the state's workforce development programs (Michigan Department of Career Development, 2000). The state's 25 Workforce Development Boards were made up primarily of business and community representatives, and educators were accountable to those boards for the use of school-to-work funds. In areas of the state where school and business relationships were strong (such as Macomb and Kalamazoo counties), these initiatives had more support. In other areas, according to J. Williams, Director of the Michigan Department of Career Development's Office of Career and Technical Preparation (personal communication, October 2001), educators and employers struggled to find common ground, and educators saw the initiative as a work-based program.

Another challenge in implementing systemic reform initiatives in Michigan was related to the state's decentralized system of local control (Jacobs & Teahen, 1998). Implementing systemic reforms in a system of local control is more likely to result in variable than standard practice (Elmore, 1980). On the other hand, it was the variability of practices, or the various best practices seen throughout the state, which helped the state determine the structure for its current Career Preparation System (discussed in the next section). (See McLaughlin (1987) for elaboration of this general point.) In particular, at conferences hosted by the state each year around school-to-work, there were a multitude of sessions where people shared their best practices. J. Mahoney (personal communication, October 2001) asserted that this allowed the state to learn about the "smorgasbord" of activities and take the best of them to design guidelines for all districts to follow.

The Career Preparation System

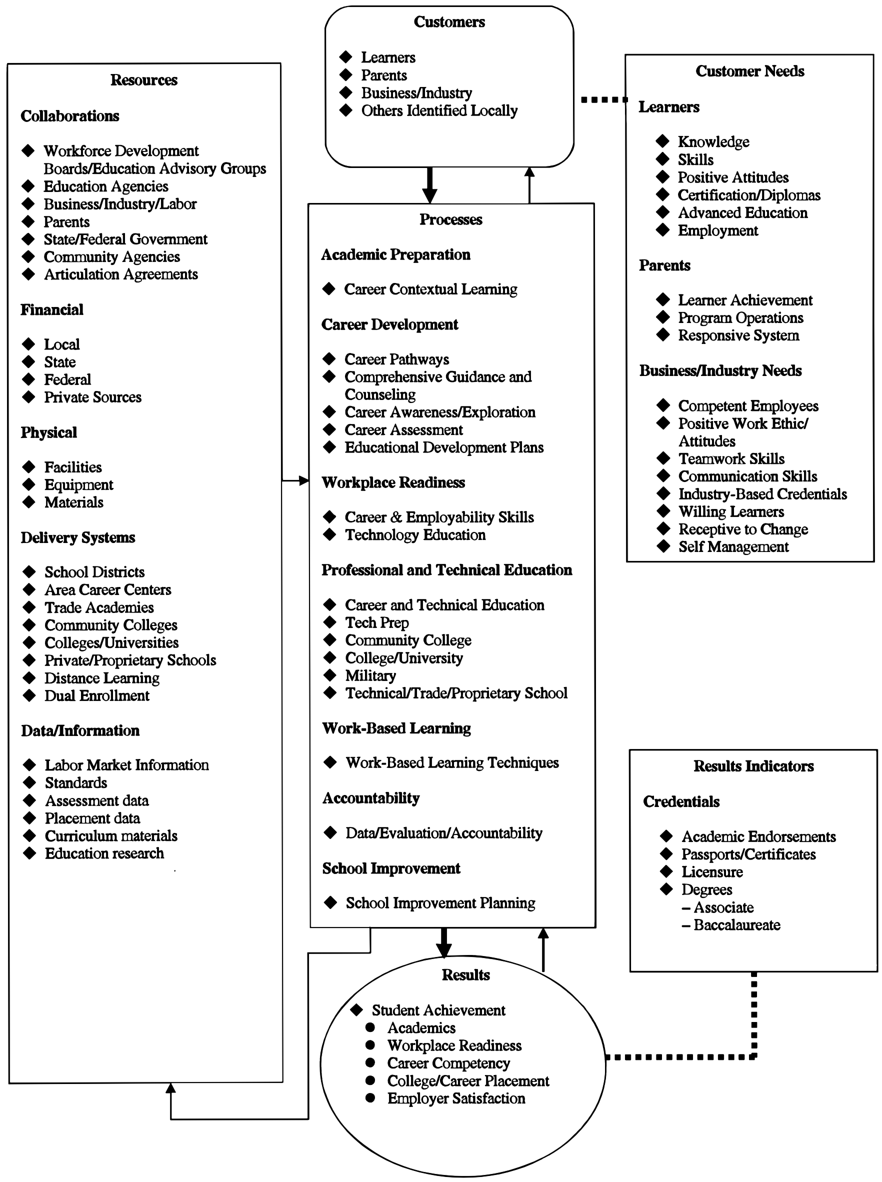
In 1997, Governor John Engler articulated the design of a state-wide Career Preparation System, and the legislature supported the system with a revision to the School Public Aid Act, which currently supports the system with $24 million a year (Michigan Department of Career Development, 2000). The Career Preparation System incorporated the aims of the school-to-work initiative, but broadened the scope of activities, participants, and goals. Similar to the STWOA, the Career Preparation System aims to " . . . ensure that each graduate will receive a quality education to prepare for higher education and their first job in today's competitive market" (Michigan Department of Career Development, 2001, p. 1), and that " . . . [a]ll students completing the Michigan education system will have the necessary academic, technical, and work behavior skills for success in a career of their choice and lifelong learning" (Michigan Department of Career Development, 2001, p. 3). Figure 3 provides a schematic description or "map" of Michigan's Career Preparation System (Michigan Department of Career Development, 2001). The diagram represents the flow of resources and processes that serve customers of the Career Preparation System, resulting in student achievement in academics, workplace readiness, career competency, college and career placement, and employer satisfaction.

Michigan's Career Preparation System calls for schools to provide curriculum that emphasizes application of academics, opportunities to provide all students with career exploration and guidance, and general employability and technology skills. The system also calls for the majority of high school programs to coordinate with postsecondary programs at community colleges and four-year institutions across the state. The voluntary system sets out guidelines for schools to follow in order to have access to state Career Preparation funds. There are three goals embedded in the Michigan Career Preparation System. They are: (1) to ensure that career preparation is fully integrated into the Michigan education system; (2) to ensure that all students, with their parents, are prepared to make informed choices about their careers; and (3) to ensure that all students have the types and levels of skills, knowledge, and performance valued and required in their education and career choices.

Turning to Figure 3, the Career Preparation System is composed of seven "components" and 17 "activity" categories. The seven components or broad focus areas of the system are academic preparation, career development, workplace readiness, professional and technical education, work-based learning, accountability, and school improvement. On the Career Preparation System map (Figure 3), the state places the components and their accompanying activities under the category of "processes." The map also defines customers of the system–including learners, parents, and business and industry–and customer needs.

Other aspects of the Career Preparation System that appear on the map are the resources that flow into the processes, results of the processes, and indicators of results. Listed as resources of the Career Preparation System are: collaboration with employers, community groups, educational institutions, parents, and government offices; financial resources from local, state, federal, and private sources; physical resources including facilities, equipment, and materials; systems for the delivery of services including school districts, career centers, trade academies, colleges and universities, private schools, dual enrollment, and distance learning; and data and information resources such as labor market data, standards, assessment data, placement data, curriculum materials, and educational research. Intended results of the system, as indicated in the map, are academic achievement, workplace readiness, career competency, college/career placement, and employer satisfaction. Indicators of results include academic endorsements, certificates, licensures, and college degrees.

Figure 3. Michigan's Career Preparation System Diagram



Two of the major elements in the state's Career Preparation System that developed from elements of the school-to-work initiative are Career Pathway Programs and Education Development Plans for secondary students. The Career Preparation System defines Career Pathways as " . . . broad groupings of careers that share similar characteristics and whose employment requirements call for many common interests, strengths, and competencies" (Michigan Department of Career Development, 2001, p. 5). Each Career Pathway curriculum area covers state academic standards, but does so within the context of career areas, in an effort to increase the relevance of the material to individual student interests. The state has defined six career pathways in the Career Preparation System. They include: Arts and Communication; Business Management, Marketing, and Technology; Engineering/Manufacturing and Industrial Technology; Health Sciences; Human Services; and Natural Resources and Agriculture. The Career Preparation System also calls for Education Development Plans (EDPs) for every secondary student in the district. These plans must include: personal information; career pathway goals; educational/training goals; career assessment results; plan of action; and parent/family consultation and endorsement for students under the age of 18.

As the development of the Career Preparation System was underway, there was an effort by the state to address the concerns of educators who saw past and current school-to-work efforts as work-based. In 1998, the state redesigned its system of Workforce Development Boards to include Education Advisory Groups (EAGs). Education Advisory Groups are advisory committees made up of academic and career technical educators from intermediate and local school districts as well as representatives from business and industry. Money for career preparation activities is now funneled through the state's 25 EAGs, which require a plan from school districts as to how money will be used and how the local efforts will support the regional vision for career preparation. In addition, the EAGs designate public educational agencies to serve as the fiscal agency for their particular region, and these agencies provide planning/coordination/oversight for Career Preparation funds that flow into the region (Michigan Department of Career Development, 2001, p. 18). Figure 4 details the flow of funds in the Career Preparation System.

Another shift the state made to offset the reticence regarding work-based programs, and hence to increase participation in state career preparation efforts, was to change the name of the program from "school-to-work" to "career preparation." State and local career preparation representatives interviewed reported that the state changed the terminology because "school-to-work" was perceived by too many parents, educators, and community members to mean vocational or technical education.

Interviews with representatives from all 25 of the state's EAGs and with several representatives from the Michigan Office of Career and Technical Preparation, including the coordinator of career and technical preparation, were used to learn more about the implementation of the Career Preparation System (and to learn about the scope of evaluation activities that have taken place to measure the impact of school-to-work activities on youth employment, discussed below). In talking with EAG representatives, it became evident that some EAGs require more accountability than others. In Muskegon and Oceana counties, for example, districts must provide a signed contract that specifies how quality criteria will be met and measured. The contract is a performance-based model in which districts are paid according to the number of students served, the number of work-based learning placements achieved, the number of teachers participating in teacher-in-industry training, or other activities outlined in the contract by the EAG. According to the area's EAG chair and Muskegon Area Intermediate School District Superintendent, it is the system of accountability that is helping to spread the Career Preparation System throughout the school districts (personal communication, M. Bozym, November 2001).

Figure 4. Funding Stream to Support Career Preparation Activities

Allocations for Michigan's Career Preparation System

Michigan Legislature

⇓

Michigan Department of Career Development

⇓

Workforce Development Boards

⇓

Education Advisory Groups
(25 in the state)
(Educators, local and intermediate school district superintendents, business leaders)

⇓

Intermediate School Districts and/or Individual School Districts

In terms of participation, the state's efforts to build a Career Preparation System are succeeding, based on figures reported in the 1999-2000 Michigan Department of Career Development Progress report (Michigan Department of Career Development, 2000). In 1998-99, 90 percent of Michigan school districts participated in voluntary Career Preparation programs. In addition, more than 60 of the state's high schools during the 2000-2001 school year were in the process of implementing Career

Pathway programs. Finally, according to the district educational plans reported to the State of Michigan, 88 percent of the state's school districts have committed to implementing Education Development Plans for each secondary student and developing a Career Pathways curriculum by 2004 (personal communication, J. Williams, Michigan Department of Career Development, October 2001).

Evaluating School-to-Work in Michigan

This section turns to the central goal of our research, which was to assemble and assess all available information that could be used in evaluating whether school-to-work as implemented in Michigan is achieving the goal of helping students better prepare for success in the labor market. We used our phone interviews of representatives of the state's 25 EAGs, and discussions with the Director and several other representatives from the Michigan Office of Career and Technical Preparation, to identify and then gather any available measures or existing studies regarding how effective these activities are for youths in Michigan.

The interviews were conducted mostly in the fall of 2001, with some follow-ups in the spring of 2002. There was not a formal interview protocol, because we were not so much interested in qualitative or quantitative data obtained directly from the interviewees, but rather in information they could provide on evaluation efforts in the geographic areas they covered, or statewide. That is, the interviews were used to identify any evaluation efforts or studies that had been done or were under way, but to a large extent the core information we present and the critical analysis we offer is based on the evaluation efforts or studies themselves, rather than the direct content of the interviews. Nonetheless, we took great care to explain to the interviewees the kinds of information or studies for which we were searching, and often had to have numerous conversations to clarify the nature of our inquiry and to follow up on leads they had provided concerning evaluation studies. We did, though, also use the interviews to flesh out our understanding of school-to-work institutions and of evaluation efforts in Michigan, in cases where printed sources were inadequate.

Like the tech prep initiative (Jacobs & Teahen, 1998), little data have been gathered in the state to show how school-to-work initiatives in general, or the state's Career Preparation System in particular, are affecting students' decisions about careers or their career outcomes. However, we did find some information from the state's annual follow-up survey of career and technical education students, and from five other studies of school-to-work at the local level.

To effectively determine whether the state's Career Preparation System (or earlier school-to-work programs) produce better prepared students who are making better career decisions and experiencing better career outcomes, evaluation studies should compare outcomes for students who have participated in these activities–the treatment group–with outcomes for comparable students who have not participated in these activities–the control group. The control group is essential to eliminate spurious inferences of positive (or negative) effects attributable to other variables associated with both school-to-work participation and outcomes. For example, if youth labor markets are improving at the same time that school-to-work is expanding, we have to be careful about attributing greater labor market success to school-to-work. Such an inference would only be valid if students participating in school-to-work fared *relatively better* than other (comparable) students. (See Porter (1997) for a discussion of this point with regard to education research, Neumark and Joyce (2001) for the particular context of school-to-work, and Heckman, Lalonde, & Smith (1999) for a thorough discussion of evaluation studies.) Ideally, students should be placed in control and treatment groups based on random assignment, although as Heckman et al. (1999) point out, this is not necessarily a panacea, and is often not practical. In practice, statistical methods of adjusting for differences between non-randomly selected treatment and control groups are likely to be necessary.

In general, our search for evaluations of school-to-work activities in Michigan revealed a handful of such studies, and most have some serious limitations. With that said, though, there are some valid reasons for the lack of such studies, so our main message is not to criticize the current lack of evaluation studies, but rather to encourage such studies to be undertaken in the future. First, the complexity of social sciences, in which multiple human factors affect outcomes, leads many researchers to believe that mixed methodologies such as surveying, interviewing, and observation are required to truly understand the root of the outcome (Dunn, 1994). J. Mahony (personal communication, November 2001), of the Office of Career and Technical Preparation, suggested that the complexity of analysis that might be needed to fully evaluate school-to-work may have inhibited the state or the majority of the state’s practitioners from engaging in significant evaluation. Second, the state’s tech prep efforts indicate there are other challenges to evaluating student outcomes early in the process of systems building (Jacobs & Teahen, 1998). Some of these include confusion over what constitutes success, and a lack of students involved in the program long enough to measure the impact of their participation. Jacobs and Teahen also reported that the many changes occurring within the state’s decentralized education system made it difficult to determine whether changes were the result of tech prep or some other initiative. The same is likely true of the evolving Career Preparation System. In the remainder of this section we review the available evaluations, both summarizing their findings and, most importantly, assessing their ability to establish causal effects of school-to-work.

State-wide Data

Mathematica study. Representatives from the EAGs and the Office of Career and Technical Preparation reported that most of the activity regarding measurement and assessment of the STWOA in Michigan occurred through participation in a national school-to-work study by Mathematica Research, Inc. (Hershey et al., 1999). According to J. Mahony (personal communication, November 2001), “There was a sense that if people were using their resources for evaluation, they wouldn't have anything left for program implementation." The Mathematica report indicates that 90 percent of Michigan's schools participated in some school-to-work activity during the STWOA funding period. During that time, more than 80 percent of the participating schools provided data to Mathematica. As one of Mathematica's eight study states, Michigan schools participated in surveys, observations, and interviews with Mathematica researchers during 1996, 1997, and 1998.

While the Mathematica study provides a national picture of school-to-work initiatives, little information was disaggregated to isolate findings from specific states. Therefore, while Michigan schools actively participated in the research efforts, little evaluation specific to Michigan's school-to-work initiatives was provided. In addition, the Mathematica study did not constitute an evaluation per se, as it did not attempt to assess the causal relationship between student outcomes and school-to-work. As the study argues:

> The evaluation can help us understand the extent to which a STW system is being created and how students' experiences are changing. It cannot, however, provide evidence of whether STW activities cause changes in student outcomes. STW implementation generally involves broad and diverse initiatives that in varied ways touch most or all students, so it is impossible to distinguish between participants and an unaffected comparison group. (Hershey et al., 1997, p. xviii)

In other words, the authors contend, it is not even possible to define treatment and control groups. While the Mathematica study offers data showing that students in school-to-work programs receive more training and are employed in a broader range of industries than are other students in paid positions, Neumark and Joyce (2001) counter that the Mathematica report lacks evidence that the cause of these outcomes was the school-to-work experience, suggesting instead that "Students most likely (to find these jobs) may simply have sorted into school-to-work programs" (p. 668). This problem with comparing non-randomly selected treatment and control groups is referred to as the "selection problem" in evaluation studies. In addition, Neumark and Joyce argue that the Mathematica study could, in principle, have carried out something more akin to an evaluation, exploiting the variation across school districts and states in the incidence of school-to-work partnerships supported by grants under the STWOA.

A study commissioned by the state by Detroit-based Moore & Associates, Inc., provided to the state in November 2000, appears to be based in part on a review of data submitted for this national evaluation, as well as interviews with school-to-work coordinators or directors at the Michigan Works! offices. (This study was not publicly available, but was described in a personal communication with J. Mahoney, October 2001.) It provides some participation data and a summary of interview responses, indicating that most respondents believed school-to-work initiatives were making a difference to students by increasing opportunities for career awareness.

However, the study includes no evaluation of the impact of these opportunities on students' career decisions.

Career and Technical Education Survey. The limitations of the Mathematica study also appear in the majority of studies on school-to-work programs in Michigan. At the state level, the Michigan Office of Career and Technical Preparation, through their Follow-up Survey of Completers in Career and Technical Education, collects data on career and technical education students who recently graduated, to determine how their high school experiences relate to their current job or schooling. However, the surveys are required to be given only to students in career and technical education programs, providing no comparison with students not in such programs, let alone attempting to control for selection of students into these programs.

The state's 2001 Follow-up Survey of 2000 Completers in Career and Technical Education shows a breakdown of how participants perceive the relationship between their current job and education and their secondary career preparation experiences (Michigan Department of Career Development, Office of Career and Technical Preparation, 2001). The survey results show the following: 18.1 percent of the 4,966 respondents report current work and education as related to their secondary career preparation programs; 7.2 percent report that neither their work nor their current education are related; 3.2 percent report that their job is related, but their current education is not; and 8.6 percent report that their current education is related, but their job is not. Yet it is unknown if these percentages have a direct relationship with career and technical education. It could be, for example, that the same percentage of all students, regardless of their high school experience, find their postsecondary work and school relevant to their high school education. Another shortcoming of this evidence is that by limiting surveys to students in career and technical programs, no data are collected to assess broader career preparation activities–such as Career Pathways curricula, job shadowing, internships, career visits, or career fairs–for students who have not enrolled in career and technical education programs.

A few EAG representatives report using the state surveys as an assessment tool for all graduating seniors. In particular, representatives from EAGs in Macomb, Gratiot, Ionia, Isabella, and Montcalm counties reported distributing the state survey to all students, and extending the survey to collect data that connects students' high school career preparation activities to their current education and employment. This is a promising development, but our interviews yielded no indication that EAG areas have made much progress in their evaluation efforts. There is, though, some indication that the state is taking steps to move evaluation of the Career Preparation System forward, as J. Mahoney (personal communication, November 2001), of the Office of Career and Technical Preparation, reported that a career preparation accountability committee reportedly has been established at the state level to look at issues of assessing the effectiveness of career preparation activities in better preparing students for careers.

Local Data

Some practitioners in the state are also making efforts to evaluate the effects of career preparation for their graduates. A report by one of the Michigan Works! agencies stated that all Berrien county high schools have adopted the Career Pathways model and are in the process of measuring the impact of the results for every graduating student (Michigan Works! Agency, 2001). Other local efforts we found that attempt to evaluate the effectiveness of school-to-work or career preparation activities for students include annual reports on Kalamazoo County's Education For Employment (EFE) program, Marquette-Alger Intermediate School District's (MAISD) school-to-work initiative, and follow-up studies of students in Macomb County.

Berrien County. Data collected so far in Berrien County suggest that the district's adoption of the Career Pathways model led to large increases in student enrollments in math and science courses and in career and technical education (Rudy, 2001). These data indicate a dramatic increase in career and technical education enrollment, from 895 students in 1997 to 5,554 students in 2001. Likewise, enrollment in 3rd year math programs increased from 686 students in 1997 to 2,080 students in 2001, and enrollment in 3rd year science programs increased from 769 students in 1997 to 2,389 students in 2001. The Berrien County report also shows large increases in the number of students enrolling in postsecondary education either as high school students through dual enrollment or as graduates. In 1997, 62 high school students were enrolled in college level courses, increasing to 299 in 2001. Similarly, in 1997 61 percent of Berrien County graduates attended postsecondary institutions, rising to 69 percent in 2001.

These data, which coincide with the implementation of Career Pathways and Education Development Plans, suggest that these activities have had a positive effect on students' postsecondary enrollments and career preparation. Of course, in line with our general point regarding evaluation studies, it is difficult to conclude that these impacts are attributable to school-to-work programs, without a comparison showing relative gains with respect to students in other districts where these efforts were not implemented.

MAISD school-to-work initiative evaluation report. The Education and Human Services Committee of the Lake Superior Community Partnership commissioned a study to assess the effectiveness of school-to-work initiatives in schools served by the Marquette-Alger Intermediate School District (Dubow & Mourand, 1999). The local plan for the MAISD school-to-work initiative was to engage the community in the preparation of young people for work. The local efforts focused on high school students' work-based learning experiences, with career planning beginning as early as elementary school (Dubow & Mourand, 1999). The local plan intended to accomplish the following: promote the use of local businesses for the development of work-based learning programs; restructure the role of counselors and teachers to provide students with access to school-to-work activities and better information to make career decisions; promote two high school pathways–Tech Prep and University Prep; form partnerships through four local school-to-work focus groups with more than 50 percent membership from businesses; and hire local school-to-work coordinators in participating counties.

The intent of the study was not to address how well each of the above goals were met, but rather to " . . . paint a picture, based on the information and perceptions of key stakeholders of Marquette and Alger Counties, regarding the school-to-work initiative" (Dubow & Mourand, 1999, p. 7). Researchers gathered quantitative data on all of the area's high school students to measure progress on the state's five school-to-work goals. The researchers reported that MAISD met the state's graduation rate goal of 90 percent, and that 98 percent of the area's graduates were employed or attending a postsecondary school one year following graduation, which they characterized as falling short of state goals (although it would seem unreasonable to expect 100 percent success). (We have not been able to identify the source of the state standards cited in this study.) While approximately 38 percent of the area's high school seniors completed a career and technical course in 1997, the authors reported that there was no state-certificate program available at the time the data were collected, making it difficult to achieve the state goal of certification for 35 percent of seniors. Data also indicate that 75 percent of the area's students participated in a work-based learning experience, versus the state goal of 100 percent participation, and about 86 percent of students in the area achieved an endorsed diploma in communication arts, mathematics, and science, versus the state standard of 90 percent.

To attempt to establish progress due to school-to-work, data on some goals such as academic achievement, employment, and graduation over three years are provided. But there is in fact little evidence that establishes this progress. For example, follow-up surveys of graduates at all of the MAISD high schools for 1995, 1996, and 1997 indicate a consistent rate of 25 percent of graduates employed full-time. While the number of students participating in school and work increased each of the three years, the number of students enrolled in school alone decreased in each of the three years. The result is a slight increase in the share of students either enrolled in school alone or in school and working, from 64 percent in 1995 to 66 percent in 1996, and remaining at 66 percent in 1997. The share of unemployed graduates was consistent at 2 percent for all three years. Other data presented are simply for one year, providing no comparison to gauge progress on state goals, and–echoing our earlier criticism–providing no indication that the outcomes represented in the data are a direct result of school-to-work activities.

The report's qualitative data provide some evidence that school-to-work activities help students better connect to career interests. For example, responses from educators as to the strengths of school-to-work included statements such as "students find out they don't like certain types of work" (Dubow & Mourand, 1999, p. 11). However, most of the questions and responses in the report reflect the local plan's efforts to build partnerships among businesses and schools and to establish priorities for school-to-work within schools and communities. Based on the qualitative data, the authors contend that key issues regarding the effectiveness of the school-to-work efforts are the need for a school-to-work coordinator to help build partnerships between educators and employers and to coordinate school-to-work opportunities for students, and the priority of school-to-work activities within the school community. Much of the MAISD study underscores the systems issues discussed earlier (Jacobs & Teahen, 1998), such as the need for educators and parents to see value in school-to-work activities for all students. Overall, there is little evidence in the MAISD report that directly ties school-to-work activities to youth employment (or education) outcomes.

Kalamazoo County's Education for Employment (EFE). Kalamazoo County provides career and technical education for a broad range of careers, offering both classroom-based and work-based programs through its EFE program. The classroom-based programs are conducted in schools, post-secondary institutions, or work sites, and cover 30 different occupations. Work-based programs supplement classroom-based programs by including cooperative learning (co-op), business/industry worksite training, and apprenticeships.

Kalamazoo County's EFE program commissioned the Upjohn Institute to conduct a study of its programs through annual follow-up surveys with program participants. In addition, Upjohn conducted focus groups with students engaged in EFE programs in 1996. Surveys of participating students and completers were conducted covering the period 1996-2001, to garner an understanding of the impact of the EFE program on career and postsecondary decisions, opinions about EFE programs, and trends in EFE experiences and employment.

Approximately 2,500 students in Kalamazoo County were enrolled in EFE programs at the time of the surveys conducted in 2001 (Hollenbeck & DeBurman, 2001). Results from the focus groups and surveys suggest that the school-to-work experiences of students in EFE have an impact on the students' career decisions. "The programs provided students with information that helped them to select specific institutions and to narrow their fields of study. Articulation agreements allowed students to acquire college credits for courses they were taking, and work experiences allowed students to gain hours toward occupational certification" (Hollenbeck, 1996, p. 27). Even though the study surveyed only students involved in the EFE programs, the Upjohn Institute study does attempt to offer some causal evidence based on a comparison of student groups. For example, students enrolled in EFE programs may participate in programs with work-based learning components or programs without work-based learning components. By surveying students in both of these EFE tracks, the data indicate some differences between students who have experienced work-based learning and those who have not.

The study indicates, for example, that work-based learning experiences affected students' choices of postsecondary programs. " . . . [S]tudents who were not in a work-based program in high school were much more likely to report that their EFE training was not at all related to their field than the students who were in a work-based program" (Hollenbeck, 1996, p. 46). Specifically, survey data from students in 2001 indicate that students' participation in EFE programs influenced student decisions to attend a postsecondary institution for about 40 percent of the students. In addition, about two-thirds of the survey respondents who were in postsecondary programs and who have selected a field of study reported that it was related to the EFE class either "a lot" or "somewhat."

But because EFE students self-select into particular EFE programs, determining for themselves whether they will enroll in a work-based program, it is possible that there are characteristics of students who self-select into work-based programs that are associated with better career decisions, or greater focus on career decisions at this point in their lives. However, the 1996 focus groups with EFE students suggested that students who were exposed to work-based learning were better able to make career decisions based on their experiences. The study cites three specific types of benefits based on the student interviews: exposure to all aspects of an industry; identification of specific careers; and development of personal contacts with employers.

Employment data on EFE graduates indicate that two-fifths of the students who were working reported using skills and training received in their EFE classes. The other three-fifths, however, reported using "hardly any" of their EFE skills and training. These data are not broken down according to students who were in work-based or non-work-based programs, so again it is difficult to determine if work-based experiences make a difference to whether students are using their training on the job. And data from a comparison group of students not enrolled in EFE would provide a basis to determine whether the programs had any effects at all.

Finally, some of the most recent employment figures are, at least on the surface, discouraging. Employment data for the 2001 report show a decrease in the number of participating students who were currently employed in jobs other than those affiliated with the work-based EFE programs, which could suggest failure to move students into jobs outside of the school-to-work system. The percentage dropped from 60 percent in 1996 to 50 percent in 2001, although the drop may have been caused by increased enrollment of 9^{th} and 10^{th} grade students (Hollenbeck & DeBurman, 2001). In addition, the 2001 employment rate of EFE completers was lower than in any of the previous years. In 2001, 75 percent of completers surveyed were employed compared with 82 and 88 percent in the previous two years. However, the 2001 survey was conducted earlier in the year than the previous surveys, which might account for the discrepancy in employment figures (Hollenbeck & DeBurman, 2001, p. 49). Finally, some of the 2001 results may also have been influenced by a slowing economy, yet again emphasizing the need for a comparison group.

Macomb County. A series of five-year follow-up telephone surveys of Macomb County graduates was initiated by the Macomb County School-to-Work Partnership in 1997. The fourth poll by the group, now called the Macomb County Career Preparation System, was conducted in 2000 and covered students who graduated in 1995 (Macomb County Career Preparation System, 2000). This survey–the Macomb County Five-year Follow-up Survey of the Class of 1995–provides data on the educational programs attended by 1995 graduates, the kinds of careers chosen by graduates, and their employment and expected and actual income. None of these data, however, are tied to students' experiences in high school school-to-work programs. The survey does, though, ask graduates about the effectiveness of high school counseling in finding postsecondary education, training, and careers, and there is a brief discussion of the impact high school employment had on graduates.

Whereas a 1995 survey of Macomb County seniors indicated that 97 percent of the respondents planned to continue their education following graduation, data from the five-year follow-up survey indicate that 90 percent of the respondents attended some type of "formal education" or education leading to a diploma, degree, or certification upon completion. Eighteen percent of the respondents who reported attending an educational program also reported not completing the program. Without knowledge of the school-to-work initiatives that may have influenced students' postsecondary education and career decisions, or a comparison group, data from the follow-up survey provide no indication about the relationship between the county's school-to-work or career preparation system and student career and education outcomes.

A review of survey results from the previous three years is also presented in the report. A comparison shows that college enrollment rose 10 percentage points from the class of 1994 (77 percent) to the class of 1995 (87 percent). However, approximately the same difference exists between the class of 1993 (84 percent) and the class of 1992 (75 percent)–classes graduating prior to the STWOA–indicating that it is difficult to draw any inference of an effect of the STWOA. There was a significant decrease, however, in the number of students who reported not attending any further education from the class of 1994 (17 percent) to the class of 1995 (10 percent), possibly indicating that school-to-work initiatives help more students see the need for further education. But without more information about school-to-work activities and students' participation in them, it is impossible to determine if school-to-work helps explain the drop.

The Macomb County Five-year Follow-up Survey of the Class of 1995 indicates that about half of the 1995 graduates believe high school counselors could do a better job preparing students for college, postsecondary training, or careers. Students who engaged in training and education programs other than college gave a more favorable assessment of high school counseling than other students, with only 48 percent reporting that high school counseling could be improved. In contrast, of the graduates who went on to college and responded to the survey, 59 percent indicated that high school counseling for helping students explore what various colleges had to offer could be improved, and 57 percent indicated that improvements could be made in helping students find ways to finance a college education. Among all of the survey respondents, 55 percent reported high school counselors could have provided more help in exploring and choosing a career.

Employment rates of Macomb County graduates have remained consistent over the past four years, with unemployment at 2 percent for the classes of 1995, 1993, and 1992, and unemployment slightly lower at 1 percent for the class of 1994. The class of 1995 reported a lower number of respondents employed full-time (71 percent) than in the other three years (78 percent in 1994, and 73 percent in 1992 and 1993), and a higher number of respondents employed part-time (19 percent) than in the other three years (14 percent in 1994, 17 percent in 1993, and 16 percent in 1992). Both the class of 1995 and the class of 1992 reported 7 percent of graduates attending school five years after graduation, higher than the classes of 1994 (4 percent) and 1993 (5 percent). Again, the employment data offer little evidence on the effectiveness of school-to-work or the career preparation system without any tie to students' high school career preparation activities, and aside from that, indicate no clear trends over time that might at least informally be linked to school-to-work.

The report also discusses the impact of employment during high school. Eighty-eight percent of the respondents of the class of 1995 reported having a job during their senior year in high school. Of these students, 76 percent reported that their high school jobs had no effect on the grades they earned in high school and 67 percent said that their high school job did not influence them at all when it came to choosing a career. Sixty-six percent, however, said their high school job helped prepare them for the world of work. Of course, because of selection into high school employment, and because these data are self-reported perceptions of preparedness rather than objective measures of outcomes, such results are not too informative about the impact of work in high school.

Discussion

Building on the state's tech prep initiative, school-to-work in Michigan has resulted in a comprehensive Career Preparation System, which is being adopted by most of the state's school districts. This fact alone provides evidence that the goal of the STWOA to build a system of career preparation for all students has been successful in Michigan. But what has been the impact of these activities on Michigan students? State-level evaluation work has focused on students in career and technical education programs. In general, outcome-based assessment activities other than the collection and reporting of data on career and technical education for the state have not been universal or even widespread. We did, though, uncover some local studies of school-to-work at the level of counties or school districts. Overall, the strength of the evidence in this limited set of studies in support of positive effects of school-to-work or career preparation activities on student career education, training, and employment, is weak. But for the most part, at this point there is simply insufficient information to provide either a constructive assessment of school-to-work in Michigan, or much guidance for improvement. At best, there are a couple of instances of suggestive evidence that career preparation activities may assist with students' career and employment decisions, and that work-based learning experiences, in particular, may help students make better career decisions.

In contrast, there is somewhat more information available on the progress local school districts and the state have made toward building a career preparation system. Assessing this progress can provide some useful information with regard to school-to-work, including: the implementation of school-to-work; the number of students being served by the system and characteristics of those students; the number of students earning employable certification; and the extent of employer participation. However, these "progress reports" generally do not provide any information on the causal impact of the system on student outcomes such as attendance, discipline, academic achievement, graduation rates, and enrollment in postsecondary education, or on labor market outcomes.

The goal of this paper was to ask whether by engaging in an exhaustive case study of school-to-work initiatives in one state a more compelling picture of beneficial effects of school-to-work programs would emerge than has been established by the work done on this question at the national level. Unfortunately, the answer appears to be in the negative.

But we hope that this case study helps to clarify some of the imperatives for future research on school-to-work. To gauge the impact of school-to-work programs on students, evaluators need to look at the outcomes of students in relation to their career preparation activity. Equally important, efforts should be made to rule out other causes for changes or differences in student education, employment, and career outcomes. Finally, efforts must be directed to assessing the effects of school-to-work on all students, not just those enrolled in particular programs (such as, in Michigan, career and technical education). The difficulty in engaging in evaluation activities during program implementation is apparent, but waiting until full implementation is achieved can lead to important missed opportunities. In particular, beginning to collect data on student career outcomes before all students are participating in a school-to-work system can provide at least some data that can be helpful in constructing comparison groups that can be used to help evaluate the effects of career preparation on students. Efforts such as those in Michigan to develop a career preparation accountability committee are on the right track.

But it is most important that government bodies responsible for school-to-work not delay efforts to formally evaluate school-to-work programs, including collection of data while implementation remains incomplete, and consideration of whether some components of implementation of the system–not necessarily restricted to ex post data collection, but perhaps also expanded to include, for example, differential program treatments across geographic regions–may be utilized to construct more rigorous evaluations of school-to-work programs. Indeed, we would go so far as to suggest that serious thought be given to including mandates for rigorous evaluation in any future legislation allocating funds to school-to-work. A related policy was pursued in the run-up to welfare reform in the early 1990s, as states requesting waivers from federal welfare regulations in order to try implementing their own welfare reforms were required to engage in experimental evaluations of their waiver programs. Blank (2002) describes the results of these evaluations as contributing importantly to the federal reforms adopted in 1996.

References

Bailey, T. R. (1995). *Learning to work: Employer involvement in school-to-work transition programs*. Washington, DC: The Brookings Institution.

Blank, R.M. (2002). Evaluating welfare reform in the United States. *Journal of Economic Literature*, 60, 1105-1166.

Dunn, W. (1994). *Public policy analysis*. New Jersey: Prentice Hall.

Dubow, K., & Mourand, D. L. (1999). *School-to-work evaluation report*. Marquette, Michigan: Lake Superior Community Partnership.

Elmore, R. (1980). *Complexity and control: What legislators and administrators can do about implementing public policy*. Washington, DC: National Institute of Education, Department of Health, Education and Welfare.

EPIC-MRA. (1997). *Statewide survey on school-to-work*. Lansing, MI.

Heckman, J. J., Lalonde, R. J., & Smith, J. A. (1999). The economics and econometrics of active labor market programs. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics, volume 3* (pp. 1865-2097). Amsterdam: Elsevier Science B.V.

Hershey, A. M., Silverberg, M. K., & Haimson, J. (1999). *Expanding options for students: report to Congress on the National Evaluation of School-to-Work Implementation*. Princeton, New Jersey: Mathematica Policy Research, Inc.

Hollenbeck, K. (1996). *In their own words: Student perspectives on school-to-work opportunities*. Washington, DC: National Institute for Work and Learning, Academy for Educational Development.

Hollenbeck, K., & DeBurman, N. (2001). *Assessment of Kalamazoo County's Education for Employment (EFE) programs, using 2001 survey data*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Hughes, K. L., Hamilton, S. F., & Ivry, R. J. (2001). *School-to-work: Making a difference in education*. New York: Institute on Education and the Economy, Teachers College, Columbia University.

Jacobs, J., & Teahen, R. C. (1998). Michigan tech prep in the midst of systemic reform. *Journal of Vocational Education Research*, 23, 115-132.

Levin, C., Sen. (September 30, 1999). Levin announces school-to-work awards for Michigan. Washington, DC: Press Release.

Macomb County Career Preparation System. (2000). *The Macomb County five-year follow-up survey of the class of 1995*. Macomb County, MI.

McLaughlin, M. (1987). Learning from experience: lessons from policy implementation. *Educational Evaluation and Policy Analysis*, 9, 171-178.

Michigan Department of Career Development (2000). *1999-2000 progress report*. Lansing, MI.

Michigan Department of Career Development (2001). *Career preparation system overview*. Lansing, MI.

Michigan Department of Career Development, Office of Career and Technical Preparation. (2001). *Respondent status profiles 2001 follow-up survey of 2000 completers*. Lansing, MI.

Michigan Works! Agency. (2001). *Report card strategic assets and comprehensive plan: Goals for the future*. [On-line.] Available: http://www.miworks.org/Comprehensive%20Plan.htm.

Neumark, D., & Joyce, M. (2001). Evaluating school-to-work programs using the new NLSY. *Journal of Human Resources, 4,* 666-702.

Office of Technology Assessment, United States Congress (1995). *Learning to work: Making the transition from school to work*, Washington, DC: U.S. Government Printing Office.

Porter, A.C. (1997). Comparative experiments in education research. In R.M Jaeger (Ed.), *Complementary methods for research in education, 2nd ed.* (pp. 523-544). Washington, DC: American Educational Research Association.

Rudy, D. W. (2001). *Career Pathways, a reform model for K-12 education*. New Buffalo, MI: Lakehouse Evaluation.

Tech Prep Task Force (1988). *Tech prep partnerships: Executive summary of the tech prep task force*. Lansing, MI: Michigan Department of Education.

Urquiola, M., Stearn, D., Horn, I., Dornsife, C., Chi, B., Williams, L., Merritt, D., Hughes, K., & Bailey, T. (1997). *School to work, college and career: A review of policy, practice, and results, 1993–1997*. National Center for Research in Vocational Education. Berkeley, California: University of California.

Acknowledgments

DAVID NEUMARK is Senior Fellow in Economics at the Public Policy Institute of California, Professor of Economics at Michigan State University, and a Research Associate of the National Bureau of Economic Research. [e-mail: neumark@ppic.org] His research interests include school-to-work, the returns to education, discrimination, affirmative action, minimum wages, living wages, and the economics of aging. ANN ALLEN is a graduate student in the College of Education at Michigan State University. [e-mail: AnnAllen@aol.com] We thank David Plank and anonymous referees for helpful comments. This research was supported by the Education Policy Center at Michigan State University. Any opinions expressed are the authors' own, and do not necessarily express the views of the Education Policy Center or the Public Policy Institute of California. Corresponding author: David Neumark, Public Policy Institute of California, 500 Washington St., Suite 800, San Francisco, CA 94127, 415-291-4476, neumark@ppic.org.

Journal of Vocational Education Research, 28(1), pp. 85-104.

The Beauty of Teacher Collaboration to Integrate Curricula: Professional Development and Student Learning Opportunities

Laura Eisenman
Douglas Hill
Rodney Bailey
Carrie Dickison
University of Delaware

Abstract

Academic, vocational, and special educator high school teams participated in a year-long, business-, school-, and university-based institute on integrated academic/occupational learning. We describe the Institute and examine its impact on teachers' beliefs and practices. Based on analyses of teachers' discussions, interviews, written products, and our classroom observations, we trace the transformation of teachers' thinking about the purpose of integrating academic and occupational curricula as they experienced other workplace cultures and implemented collaborative projects in their schools. We discuss implications for structuring professional development in ways that compensate for limited opportunities for teacher collaboration within schools and enhance students' opportunities for learning and inclusion.

Integrating academic and occupational learning is a core principle of school-to-work and vocational education reforms of the last decade (School-to-Work Opportunities Act of 1994; Carl Perkins Amendments of 1998). The emphasis on integration has been one response to the increasingly technical nature of many jobs, requiring a workforce comprised of skilled problem-solvers with strong applied academic preparation (Resnick & Wirt, 1996; Stasz, Kaganoff, & Eden, 1994; Stern, Finkelstein, Stone, Latting, & Dornsife, 1994). By reforming traditional academic and vocational curricula through integration, proponents argued that schools would increase student engagement, persistence, and learning at the secondary level and facilitate student transitions to postsecondary education and careers (Bailey, 1997; Grubb, Davis, Lum, Plihal, & Morgaine, 1991; Resnick & Wirt, 1996; Stasz et al.; Stern et al.). Integrating academic and vocational curricula also has the potential to reduce educational inequities in high schools that track students of different social, racial and ability groups into segregated academic or vocational courses of study (Grubb et al.; Oakes, Selvin, Karoly, & Guiton, 1992).

Research reviews on outcomes of integrating curricula and other school-to-career initiatives (Eisenman, 2000; Hughes, Bailey, & Mechur, 2001; Stasz et al., 1994; Stern et al. 1994) have concluded that there may be benefits for students, educational systems, and employers. However, difficulties inherent in evaluating multi-component, diverse interventions coupled with a small number of empirical studies make these findings tentative. Students appear to benefit primarily in terms of school engagement. They may exhibit greater interest in school, see connections between school and their career interests, take more challenging courses, persist toward high school diploma attainment, and increase their career awareness. Solid links to higher academic achievement have been harder to establish.

At the heart of expectations for positive effects from integrating academic and occupational curricula are fundamental changes in teaching practices. Integrated learning in its simplest forms includes individual teacher infusion of academic or occupational content into courses and collaborative interdisciplinary partnerships. At its most complex, integrating curricula appears as whole school reform such as senior capstone projects, school-based enterprises, and career academies. In whatever form, integrating curricula requires that teachers have knowledge beyond their chosen discipline areas, including practical understanding of how academic and occupational knowledge is used in non-school settings, and pedagogical skill at promoting active student-centered learning environments.

Because of the centrality of teacher-implemented curricula and instruction, professional development is a key to integrating academic and occupational learning. We created the School-to-Work Professional Development Institute to assist interdisciplinary teams of academic, vocational, and special education secondary teachers to design, implement, and evaluate integrated academic and occupational learning activities. The purpose of our study was to explore the impact of the Institute on teachers' conceptual knowledge of integrated academic and occupational learning and their professional practices. We had three guiding questions:

1. How would participation in various components of the Institute affect teachers' understanding of integrated academic and occupational learning?
2. What roles would the collaborative aspects of the Institute and different school contexts play in changing teachers' practices?
3. How would teachers' understandings of integrated learning relate to the types of projects created, implementation issues, and student learning?

Method

Design

Our questions focused on understanding the interaction and outcomes of teacher beliefs and highly contextualized activities (individual projects created and implemented by teaching teams across multiple schools) within the framework of a particular case (an institute) over time. Therefore, we chose a descriptive and naturalistic approach, which is useful for understanding the complexities of a particular case and the meanings individuals' ascribe to phenomena (Lincoln & Guba, 1985; Stake, 1995). Further, the Institute staff served as instructors and facilitators of Institute activities as well as investigators. Adopting participant-observer roles is another hallmark of qualitative research. The degree to which we were participant-observers varied -- more so during the early phases when Institute activities were primarily university- or business-based and less so when teachers implemented activities in their schools.

Institute Components

Building on recommended practices for quality professional development efforts, the Institute provided teachers with extended (year-long) learning opportunities in school, university, and business contexts and supported their collaboration with other professionals. Reviewers of the literature on inservice teacher professional development concur on several critical elements (Hawley & Valli, 1999; Little, 1993). The primary focus of all activities should be on student-learning and strengthening teachers' instructional practices and content knowledge. Further, professional development activities should extend over time to permit systematic teacher inquiry; unlike the more common and infamous "one shot workshop" approach that provides little opportunity for teachers to develop and reflect on their work. Also, professional development should be responsive to teacher-identified needs and support collaboration within a broader professional community.

When designing the Institute we also consulted professional development models specifically related to the integration of academic and occupational learning (Finch, 1999). We closely aligned our Institute with the *Classrooms That Work* model (Ramsey, Stasz, Ormseth, Eden, & Co, 1997; Stasz, 1997), because of its emphasis on observing and enhancing classroom practices, incorporation of a work-based learning component for participating teachers, and its orientation toward adopting research-based practices. The major components of that model included:

1. Six weeks of university, business, and experimental classroom-based sessions;
2. coverage of topics on an integrated learning model, related teaching practices, assessment strategies, observational methods, and action research; and
3. activities such as worksite observations, creation of problem-based curriculum units and instructional design, piloting a unit with volunteer students, and daily peer feedback on instruction during pilot.

We extended the model by forming interdisciplinary teams within schools and using an instructional team that included a university faculty member with expertise in secondary special education, the director of a state-wide business and education alliance, and a district-level school-to-work coordinator. We included additional readings, case studies, and discussions about alternate approaches to integrated learning. We provided a longer time for observations and interactions at business sites. Similar to the *Classrooms That Work* model, teachers created instructional projects as a culminating product of their summer experiences. We asked teachers to base their projects on workplace problems or issues that would address both academic content standards and generic workplace skills. We followed teachers during the school year as they implemented projects in their own schools and classes, rather than in simulated classroom situations. The teachers sought feedback about their projects from colleagues at their school, had informal meetings with project staff, and attended a mid-project session to discuss their progress. The teacher teams evaluated and then reported on their projects at a final class meeting later in the year. Table 1 provides an overview of the Institute schedule of activities.

The Institute was supported through the State's federally-funded School-to-Work Opportunities Act systems change implementation grant. Teachers received university course credit and a stipend ($800) for their full-year participation. Teachers could also request funds for project-related instructional materials ($125/teacher) and for travel related to dissemination of their projects at local and regional professional conferences ($200/teacher).

Participating Teachers

Teams were recruited by mail and e-mail sent to principals and transition specialists in all middle and high schools in the State. Teachers and others who inquired were sent information about the Institute and registration materials. Only interdisciplinary, three-member teams were accepted. Team members signed a commitment statement indicating their willingness to participate in the year-long activities, and they secured their principal's signature as an indicator of administrative support.

Four high schools created teams for the Institute: Asher, Doyle, Miller, and Thomas (pseudonyms). The schools' student enrollments ranged from 1200-1500 and drew primarily from urban and suburban areas. We wanted teams to include three teachers representing academic, vocational, and special education. In actuality the teams' compositions varied considerably as did their prior experience with collaboration. The Asher team included English, special, and business education teachers. Each had 25 or more years of experience. The Doyle team included a library media specialist, English and special education teachers. Their teaching experience ranged from 5 to 9 years. The Miller team had the least experienced teachers (2 – 3 years each). Each had responsibility for special education classes: one taught students in a functional (non-diploma) curriculum, another taught multiple academic and life skills subjects, and the third taught mathematics and English. The Thomas team included an agriscience teacher with 26 years experience, a technology teacher with 6 years experience, and a special education mathematics teacher with 2 years experience.

At the beginning of the Institute half the teachers reported limited or no collaboration with other teachers in their school during the past year. The other half stated their prior collaboration had been moderate to extensive. The most typical examples involved informal teacher-to-teacher cooperation and shared equipment for special projects. The teams exhibited varying degrees of collaboration throughout the Institute. Although the Asher team had not formally collaborated previously, they

Table 1
Institute Schedule

Phase and Time Frame	Major Topics and Activities
Summer	
Week 1 (20 hours at university)	Orientation to institute; School-to-work reforms and Workplace expectations; Models of integrated learning; Workplace observation and interview skills; Designing integrated units and related assessments; Teacher resources for integrated learning, school-to- work, curriculum and assessment.
Weeks 2 and 3 (30-40 hours at host business)	Individual and team observations and interviews.
Week 4 (hours varied)	Team meetings to develop instructional units and project plans.
Week 5 (15 hours at university and community sites)	Discuss externships; Team meetings with project staff to discuss project ideas; Project presentations to peers and feedback session; Project revisions; Brief project presentations to business hosts.
Fall and Spring	
School-based (Hours varied by team)	Monthly contacts by project coordinator; As requested meetings with project staff; Teacher team meetings; Teacher documentation of activities, outcomes, issues.
University/community-based (8 hrs mid- and end-project)	Project meeting for all teams; Final team presentations to peers; Discussion of project barriers and facilitators.

quickly formed and sustained a strong bond during the Institute. The team was recruited by one member whose colleagues said they agreed to join because she was a fun person whom they respected. They arranged to have dinner together occasionally during the summer and went on a retreat to write their final project report in the Spring.

The most experienced Thomas teacher agreed to participate in the Institute because the integrated curriculum approach “matched his philosophy of teaching” and he had “done it for years.” The other teachers on the team were recruited by him and his district's school-to-work coordinator. The teachers had worked together previously as athletic coaches and had done some informal teacher-to-teacher sharing of information and resources.

Previously, the Miller team had worked on a limited basis on collaborative projects as members of the same special education team. They characterized these prior collaborative opportunities as frequent but informal. They also reported rarely having common planning time. This team lost a member three weeks into the school year when she accepted a position at another school.

The Doyle team also had little prior collaboration and had the least success forming a team during the Institute. They had been brought together for the Institute by their school’s school-to-work services coordinator. Their special education team member withdrew before the end of the summer for personal reasons. The remaining two members struggled to find common meeting time during the year. Ultimately, they completed different aspects of their project and submitted separate final reports.

Teams were matched with host businesses based on proximity and interest from a pool of 17 businesses that had volunteered to serve as externship sites. Businesses reported that they were eager to participate because of the potential for networking and partnering with local schools. They wanted connections to their future workforce and opportunities to promote career awareness and internship activities. The final four host businesses represented a state environmental agency and finance, chemical engineering, and entertainment industries.

Data Sources and Analyses

In order to construct a description of teachers’ experiences and probe for changes that occurred in teacher understanding and practices, we collected multiple documents and interviews across the year. We engaged in ongoing, iterative qualitative analyses and used QSR NUD*IST 4 (1997) software to manage documents and support analyses.

Sources. Information sources included project staffs' notes about teachers' discussions during Institute class sessions, teacher’s project plans and reports, and teacher and business host evaluations of the Institute. Teachers completed two evaluations of Institute activities. The first was completed at the end of their intensive summer experience that included coursework, a business externship, and instructional project development. They completed the second evaluation in the Spring following instructional project implementation and submission of teams' final project reports. Business hosts completed an evaluation following the summer externship experience. Additional data sources included multiple individual and team interviews across the school year with members of two teams (Thomas and Miller) that agreed to take part in interviews and observations in addition to the regular components of the Institute. Involvement in these additional elements was voluntary and not a condition of participation. One teacher shared his project journal. We also conducted individual interviews with the two teachers who did not complete the Institute. To gain additional insight into teachers' projects, we interviewed students who participated in activities of one team and conducted two observations of those students engaged in project activities.

Semi-structured teacher and student interviews were conducted at teachers' home schools. We asked for summaries of recent project-related activities and their thoughts about what was working or not working with the project. We also asked the teachers to share ideas they had about principles or practices for integrating curricula. We then pursued ideas and issues raised by teachers and students in their responses, and we asked for commentary on ideas that had emerged from our initial analyses. We audiotaped and made field notes following each interview. Tapes were not transcribed, but were retained to assist us in verifying or clarifying the field notes. During observations, we made field notes about the students' activities, content of dialogue, materials, and forms of student involvement.

Analyses. In our early analyses we conducted open coding and memo writing on all documents, and then in later analyses we used axial and selective coding (Strauss & Corbin, 1990). We used independent open coding as a technique for making comparisons and building categories of ideas and events across documents and observers. Memo writing served as a method for organizing our initial ideas and raising questions about the activities and changes we were observing. To support axial and selective coding we constructed matrices, which were created by intersecting the codes and data from each Institute phase (initial coursework; externship; end-of-summer activities; implementation; final activities) with codes and data corresponding to major concepts within initial research questions (understanding of integrated learning; role of collaboration and context on practice; student learning). As a result of examining relationships within the codes and data, we generated three themes that characterized the major shifts that occurred in teacher understanding and practice.

We also conducted member checks following major Institute activities (e.g., after each class, during and after the externship) and after interviews or observations to compare our notes and discuss what appeared to be the critical ideas and issues. We examined these ideas and issues with teachers in subsequent class discussions or interviews and revisited them in later member checks to determine their continuing relevance to helping us understand what was happening. Faculty colleagues (external to the project) also served as peer reviewers at two critical points. First, they provided suggestions regarding approaches to data collection and analysis in the Fall when we were concerned that none of the teams might actually implement their projects. Second, they reviewed a written summary of the projects and tentative findings; offering critiques and alternate interpretations.

Credibility

Several techniques contribute to the credibility of the interpretations that arose from our analyses of this case: prolonged engagement, persistent observation, triangulation, member checks and peer debriefing (Lincoln & Guba, 1985). A potential limitation of our efforts is that not all teachers in the Institute agreed to participate in the additional interviews (due to time constraints). Additional interviews would have given us more material for comparing, contrasting, and illustrating individual teacher insights. Also, we conducted relatively few project classroom observations and student interviews, because teachers struggled to implement their projects. Thus, although we had information from all the teams across the school year from a variety of sources, our final data set contained considerably more information about two schools. We attempted to remedy this possible bias by examining whether we could find support for insights or ideas in more than one source. However, we never discounted the insights or comments of a single teacher; these were sometimes of great value in understanding underlying issues.

Although our findings led us to suggest implications for structuring future professional development on integrated learning, we do not mean this report to be used as a new and improved formula. Neither can we comment on whether or in what ways teachers sustained their integration efforts after their involvement with the Institute ended. We think this case study best serves as an illustration of, first, how recommended professional development practices interacted with particular individual and institutional resources and constraints and, second, what might be learned from engaging teachers in studying their attempts to implement innovative student-learning activities.

Findings

We present our findings within the framework of the three major themes that trace the transformation of teachers' ideas about integrated learning through the phases of the Institute. Teachers shifted their thinking about integrated learning from: (a) Being a means for accomplishing the academic goals of schools, to (b) the idea that integrated learning would be a vehicle for teaching students about the importance of teamwork, to (c) valuing the surprising possibilities for more student-directed learning and inclusion that can accompany integrated learning. The most fruitful aspects of the institute appeared to be those that facilitated teachers' boundary-crossing; i.e., activities such as the externship and cross-teacher discussions that encouraged participants to step beyond their isolated classroom-bound teaching and consider other communities of practice in relation to their own. Despite the fact that few of the teacher-designed projects were put into action (which means that few of the anticipated student learning outcomes were realized), teachers' own boundary crossing-experiences opened new opportunities for their students.

Getting Started: The Focus is Academic

In the beginning teachers' operating theories of student learning hinged on promoting academic goals by bridging separate realities of school and work. When asked to identify rationales for integrating academic and occupational learning, teachers focused on students' current roles as learners in schools and their future roles as workers. Teachers believed that integrating academic and occupational curricula would make academic schoolwork more meaningful to students. During a class discussion, one group summarized the idea this way:

"Students need to see their [school] work will hold some relevance when they are in the real world. Better to motivate them that way. Exposing them to knowledge and skills will help them be better workers."

Teachers agreed during the discussions that integrated learning activities must be feasible and "on target"; that is, they must align with schools' academic goals. As one teacher said, "the first priority is academic standards." Teachers believed that integration would not be successful unless parents and others outside the school supported their message to students that learning academic knowledge and skills must be their priority. Some teachers said that not all teachers would be willing to accommodate the activities that might occur in an integrated curriculum (e.g., being flexible about students missing class for a field trip), because of the importance of meeting academic standards. They felt there might be tension as teachers tried to balance the academic standards curriculum with "what kids need and where kids are."

When asked to identify principles that would help a teacher guide implementation of integrated learning in the classroom they suggested that integrated learning should be available to all students and promote students' sense of themselves as "life long learners." They said teachers must make schoolwork relevant to both student interests and workplace expectations. Therefore, teachers must be knowledgeable about workplace requirements, and they must know how to use this knowledge to help students meet academic standards. Teacher knowledge and skill would develop through collaboration with community groups, businesses, and teachers in other disciplines. They agreed collaboration would more likely occur in a school culture that focused on student academic learning, expected and provided time for developing collaboration among individuals, and was populated by teachers who were flexible and willing to share ideas. They suggested that ultimately teacher-to-teacher collaboration would lead to a greater sense of community within a school and students would "see teachers in a new light" and as "mentors."

Discovering Workplace Cultures: A Focus on Teamwork

Teachers reported that the externship was one of the most positive aspects of the Institute. The externship served as an opportunity to explore other workplace cultures in-depth; a boundary-crossing experience that few had undertaken before. The fact that this exploration took place in the company of other teachers as fellow travelers and provided multiple opportunities to debrief within and across teams contributed to a sense of discovery and appreciation.

All the teachers commented on the importance of teamwork and collaboration within the business cultures. Teachers observed that how workplace teams were organized and deployed varied considerably. They found the workplace cultures at their host sites to be different from the workplace cultures of their schools. One team noted the high level of competition and outsourcing in one industry, while others commented on the relaxed family environment at their host businesses. All agreed that teamwork would be the most important element of the workplace culture to transfer into their own classrooms through their projects.

When we asked about unexpected or surprising aspects of the externship, teachers reported being greatly impressed by the technology resources and support available to the businesses as well as their hosts' size, diversity, and scope of operations. They compared this to their experience of schools as technology-deficient and having limited resources or flexibility with which to tackle their daily work. They also reported being surprised -- but then again not -- to learn that some businesses, especially those employing many entry-level workers in service-oriented jobs, faced the same problems that schools did with attendance, punctuality, and "teenage attitude." We were surprised, at this point, that although each team witnessed workers successfully solving critical problems within their industries, only one team mentioned specific technical or problem-solving knowledge as something they might want students to learn.

Making plans. Following the externship, teams began creating their integrated project plans. These reflected a wide range of undertakings, most of which did not link directly to the specific industries observed during their externships. Only one team elected to initiate a completely new project (research on environmental topics) that incorporated curricular areas beyond their current course assignments, but central to the work of their host business. Table 2 lists major elements of team project plans and the discipline areas from which they selected student learning standards. As the teams shared their ideas with project staff and the other teachers, we noted their enthusiasm had been translated to some degree into projects of ambitious scope. We urged the teams to consider projects of manageable size given the resources of time and support available to them, but left the final decision about scope to them.

Table 2
Teams' Project Ideas

School	Project Focus & Major Activities	Discipline Areas
Thomas	"*Creating a Process, Not Just a Program*" School-wide recycling program supported by student-run organization network; Led by central planning committee comprised of representatives from each teachers' classes; Each teacher and his students take one major responsibility: Logistics & Finance, Resources & Personnel, and Design & Development	Science, Social Studies, English/Language Arts, Mathematics, Agriscience, Natural Resources, SCANS[a]
Asher	"*TEAM: Teens, Educators, and Mentors*" Multiple projects that engage business mentors as expert speakers and consultants to students: Yearbook web-page design; Financial services - income taxes; Children's book - writing and publishing; Research papers incorporating information from interviewing and internet searching	English/Language Arts, Mathematics, Business Technology, Accounting, Banking, & Finance
Doyle	"*Environmental Studies*" Students and teachers conduct environmental research projects designed by mentor; Students present findings to multiple audiences	English/Language Arts, Mathematics, Social Studies, Science, SCANS
Miller	"*Emerging Professionals Program*" Create a self-sustaining in-school T-shirt business; Incorporate production and marketing expertise of business mentor; Overtime, create a sequence of courses designed around the business functions	English/Language Arts, Mathematics, SCANS

[a]SCANS refers to the Secretary's Commission on Achieving Necessary Skills (US Dept. of Labor, 1991), a consensus list created by business leaders and educators of entry-level employment competencies including (1) identify, organize and allocate resources, (2) acquire and use information, (3) work with others, (4) understand complex (systems) relationships, and (5) work with a variety of technologies.

All teams incorporated specific student learning goals related to state-approved academic and technical learning standards as well as development of generic work-related skills such as teamwork. Some teachers responded strongly in their project plans and our class discussions to their business mentors' messages about the need for workers equipped with generic workplace skills and knowledge. In their project plans they wrote about the importance of promoting workplace behavior in the school (e.g., "people skills," "tolerance," "punctuality") and helping students to understand the "realities" of the working world (e.g., responsibilities of individual workers, awareness of business operations, "life skills" needed by working people). One teacher commented that it might be possible to use a generic workplace skills framework as a foundation for a schoolwide discipline policy. Another commented in an end-of-summer course evaluation: “It was interesting to me, as a special educator, to see that all students have difficulty with transitioning from school to work - too often we in special ed believe WE have a corner in this problem!!”

Few teams identified methods or timelines within their plans for assessing their wide variety of anticipated outcomes. Thus, our early feedback to the teams urged them to carefully consider more specific assessment strategies for documenting student learning and project outcomes. Through the peer presentation and evaluation process, we noted that the teams applauded each others' efforts to include diverse students in all aspects of the projects. Foreshadowing the final shift in teachers' understanding of integrated learning during the Institute, the Asher team received special praise from peers for their decision to include students for whom English was a second language, students with learning disabilities, and students taking Advanced Placement English courses in at least two of their projects.

Surprising Opportunities Despite Obstacles

As teachers began the new school year, they faced a variety of organizational challenges. Three of the four teams experienced immediate difficulties, which threw their project plans into disarray. Only the Asher team started the new school year with the staff, material resources, and administrative support they had anticipated. Within the first two weeks of school, the Miller team lost their member with the most knowledge of operating a school-based enterprise to another district. Furthermore, the school had been unable to fill two other positions within the special education department, which forced remaining team members to take on more and larger classes and caseloads than expected. The Doyle team returned to school to discover that the library had been badly damaged by water and mold. The new computers they had expected had not arrived, several others were out of service, and the library equipment and supplies budget had been cut. These factors severely crimped their project plans for conducting Internet and library research with multiple classes. The Thomas team reported that they had underestimated the start-up time needed given the presence of new administrators at their school and an incoming set of students who, they reported, needed extensive teacher-direction regarding school discipline and basic social behavior. One teacher reflecting with frustration on his team's reluctance to start the project, remarked “they have other things to do.”

Indeed, struggling to overcome unexpected and significant organizational challenges consumed most of the teachers' time and energy for the first part of the year. The greatest barrier was limited availability for collaborative project planning, which occurred for a variety of reasons: reduced staffing, larger than usual class sizes, lack of scheduled common planning time, limited physical proximity, and new course assignments for some teachers. Teachers often used terms such as “personalities” and “chemistry” to describe what held teams together. Given the numerous organizational constraints teachers experienced, interpersonal factors appeared to determine whether or not they ultimately considered themselves a functioning team. Teams' plans rapidly dissolved into individual teacher efforts with only occasional limited forays into recovering the collaborative aspects of their work. Our repeated monthly offers of technical support to individual teachers and teams were rarely accepted, with most teachers saying they simply didn't have time because they had "too many things to do."

Given the major organizational barriers, actual project implementation was extremely limited and, therefore, minimal assessment of project-related student learning occurred. Thus, we could not fully answer our initial question regarding relationships among teacher understanding, projects created, contextual issues affecting implementation and, most importantly, student learning. However, at the end of the Institute, teachers insisted they had learned a lot. Overall, the teachers reported gaining new knowledge about school-to-work and integrated learning models and new perspectives on including all students.

Collaboration as key to relevance. Although actual collaboration with businesses or other teachers was hard for teachers to manage when they returned to the isolating workplace culture of schools, their experiences with the businesses and other teachers convinced them it was important to pursue. They argued that collaboration could reduce separation between teachers, who then could provide teamwork models for students. Further, students would be more likely to have their “needs met across the curriculum”, “broaden their perspectives” and recognize the *relevance* of school experiences.

Teachers regularly used the terms real life and real world to describe what students would experience or come to appreciate through the integrated projects, however, we observed teachers take two contrasting views about how to promote relevance. In both cases, teamwork or collaboration was seen as key to making school-based learning relevant to students. In the first view teamwork was a set of social behaviors to be taught, while in the second, teamwork was a vehicle within integrated projects for pursuing new learning opportunities.

The first approach was illustrated by one long-time teacher who had been particularly excited about what she considered the “student as worker” aspects of the project. As the year progressed she reported that she had begun to “enforce workplace behavior” in the classroom. Others noted that the projects would help the students focus on “the real work force” and learn the “people skills” they lacked. “They don’t understand the concept of work,” according to one teacher. Teachers were confident that students should learn to collaborate, because that’s the way “the real world operates” and it "makes sense." Yet, some teachers thought their students lacked some prerequisite social skills for cooperative learning. One teacher noted that because his students came from very different backgrounds and didn’t know each other well, they began the year doing a lot of “uncooperative learning.” In some cases, the expectations for and actual poor social behavior of some students became rationales for slowing project implementation and defaulting to an interpretation of generic workplace skills that closely resembled behavior expectations within schools (e.g., attendance, punctuality, respect for authority).

Cultivating connections. In contrast, we observed some teachers recognize that students were more likely to perceive relevance when guided or encouraged to use problems of interest to them as bridges to the adult world of work. Ideally, these problems would be solved through collaboration or teamwork with others. Teachers said that creating opportunities for "student ownership" of real world problems was necessary for negotiating the transition from school-based learning to work-based learning. One described this as adapting teaching to "what kids are saying." One teacher who had experience with facilitating student-led learning projects expressed this in his concern that his less experienced team mates were having difficulty getting started, and that they should be “developing the stage for students to become self-starters, solution seekers, and explore new opportunities.” Another teacher on his team agreed that they needed to get “student ownership” because being involved in the projects' organizational network would mean that others would depend upon his students, which he believed would create empowering demands upon them for the first time in their school lives.

Another teacher noted that teachers who had the latitude to adapt curricula to address student and teacher interests could promote students' “professionalism”; that is, move students beyond a narrow focus on academic or occupational skills. He wished to expose them to multiple disciplines and balance his curricular emphasis according to student need. Another teacher noted the importance of teaching students how to “cultivate connections” and “keeping their eyes open for different projects and ideas," which is exactly what occurred for a member of his team.

Although their original project was slow to start and never completely realized, one teacher at Thomas High School and his students became part of an unplanned project when students overheard a conversation he had with another teacher. The radio class teacher asked him, because of his background in architecture, if he could help design and build a larger space for the school radio station. The students thought they could do it and suggested to the teachers that they all work on it. The two teachers, who had a common planning time, were able to discuss how to proceed and ultimately involved three sets of their students: Honors students studying architecture created the design; students in a building class actually constructed the space, and the radio students critiqued the work at each stage. The teacher reflected that one reason the Thomas' team original project was slow to start was that it was a fully developed and teacher-generated idea, which students had to adopt. The radio room project, although also teacher-generated, came to fruition because the students took ownership of the project in the idea stage, before it was fully developed. Both projects allowed for student planning and decision-making, but only the radio project allowed for initial input from the students and ongoing teacher planning.

In their final report, the team reiterated these themes of student-ownership and teachers' resources for supporting it. They noted "the success of any student-run learning experience lies in the reality that the students are indeed in charge of their own intellectual destiny," yet "creating and engendering student-run curriculums takes a painful amount of patience and flexibility on the part of classroom teachers." They noted that teaching with integrated learning approaches changes what teachers look like; teachers must be a guides, not just disseminators, and therefore, they must be prepared to engage students in learning in various and sometimes unplanned ways. One reported that his work in the Institute was "an eye opener so to speak - my role as a teacher somewhat changed. I had to create flexible lessons, empower students via ownership and allow students to fail."

Engaging and including diverse students. Reflecting on the teams' work at the end of the Institute, a teacher suggested "the beauty of the project is that it draws from diverse disciplines and incorporates diversity of kids." The teachers agreed that integrating curricula broadened school curricula, promoted critical thinking by students, and incorporated students who were "disenfranchised" from the typical high school academic curriculum. One teacher noted, it was possible within integrated projects that "every star shines bright."

The Asher team provided two examples of the potential link between integrated activities and facilitating inclusion of students. This team completed just two projects of their planned four (yearbook webpage development and income tax preparation service), because coordinating their efforts took more time than they had anticipated. They noted that completion of the two was largely due to the initiative of students in the special education classes who, because of their excitement about the projects, met on their own outside of classes. Just as teachers had no common planning time, most students did not have common classes or workplaces. The teachers believed that the most notable outcome of their projects was that the "normal separations between academic and special education students did not occur." In fact, for the first time in the history of the school, a student identified with special education was nominated for homecoming queen. Her new found popularity arose from her responsibility for taking photographs of students for the yearbook webpage.

The Asher team reported another student triumph that resulted from the income tax project. Business students identified an error in the professionally-completed tax return brought to them for proofing by a student with special education needs. With the support of teachers, the students in Business and English collaborated to compose a letter to the tax preparation firm on behalf of the individual student. As a result, she received a refund of her tax preparation fee. Overall, the Asher teachers reported multiple student learning outcomes from their projects including new information technology skills (e.g., web page design and financial software), mathematics strategies, problem-solving techniques, critical thinking skills, and assertiveness. However, the outcome that excited them most was that the usual social boundaries around learning opportunities had been crossed by their students.

Summary and Implications

Perhaps if the teachers' original projects had been more successful, and we had been busy assessing standards-based student learning outcomes, we and the teachers would have been less likely to consider and come to value a fundamental reason for investing time and effort into integrating curricula. Student learning via solving academic or vocational problems as defined by the teachers in their projects was not the major outcome. Instead, the process of exploring other workplace cultures and pursuing collaboration in ways that were meaningful to both students and teachers led to surprises about how integrated learning might promote student-directed learning and inclusion. The Institute's role was to support this process by providing teachers access to other workplace cultures, each other, and opportunities to reflect upon and critique the value of their efforts.

Supporting Teachers to Engage Students

Our experiences reinforced for us the idea that integrating academic and occupational learning can be a mechanism for stepping across existing social and organizational boundaries in secondary schools (Grubb et al., 1991; Oakes et al., 1992) and, thereby, opening new opportunities for students, including those with special education needs. In hindsight, we noted that we constantly encouraged teachers to focus on the student learning *outcomes* produced by their work, which was not a bad thing, but perhaps too narrow. We did not direct teachers’ attention toward consideration of how their efforts might interact with their students’ needs and interests to produce learning *opportunities*. In the future, we will engage teachers earlier in their work in more discussion about ways to engage student ownership of learning problems. For example, teachers could be asked to consider students as collaborators in investigating school and other workplace cultures as one way to better promote a student-centered approach to determining relevance of learning activities. Or, through university-supported discussions teachers might share past experiences with student-directed learning activities and consider common characteristics of these events across situations. However, because the dynamic interplay of teacher, students, and schools would prohibit a prescriptive approach, we would suggest incorporating action research methods more explicitly within professional development activities (e.g., Mills, 2000; Schmuck, 1997). We think teachers would be more disposed to recognize and respond to divergent learning opportunities if engaged with colleagues in a visible structure for posing and framing questions, considering multiple sources of data and feedback, and sharing and reflecting upon their efforts as a means for shaping future action. Although Stasz (1997), reflecting on the *Classrooms That Work* model, concluded that its action research mechanism was less important than the teacher-to-teacher collaboration that occurred, we perhaps provided too little structure for supporting systematic inquiry.

Related to this, teachers also needed more planning time, an administrative priority for their work, and longer implementation time to facilitate student ownership and overcome organizational barriers. We recognized that the creation of school teams, the initial summer work, and availability of technical support were insufficient to overcome their school-related constraints. In fact, teachers felt less favorably about the Institute structure during the project implementation phase than other aspects. The highly independent structure and minimal university-directed class time, which we thought would create greater flexibility for busy teachers, actually left them without a predictable anchor for collaboration and project refinement. We plan to provide more structure through the university in the form of more regularly established meetings during the implementation and evaluation phase to compensate for limited collaborative and reflective time in schools. These structured meetings would serve as an undergirding for the teachers' action research.

Supporting Teachers' Pedagogical Knowledge and Skills

Although we initially observed lots of teacher talk about the pressures of academic accountability, teachers' project activities and reports appeared more responsive to living within the immediate social, daily-work cultures of their schools and less attentive to the technologies of teaching closest to student learning, such as their own teaching and assessment strategies or curriculum development. This led us to conclude that we should spend more time, especially in the first phase, examining core curriculum concepts in the teachers' academic and technical disciplines and structuring activities to assist teachers to identify related concepts, themes, and problems in workplaces. Also, we noted that learning about generic work place competencies, such as SCANS (U.S. Department of Labor, 1991), became an important theme for many participating academic discipline teachers, which suggested to us that we should continue to emphasize generic workplace skills as a way that any teacher can infuse or integrate occupational learning into academic curricula.

Finally, we would build in a no-fail mechanism of having teachers create individual integrated lesson plans that they could implement and investigate even if their teams' collaborative unit failed due to organizational factors beyond their control. Besides decreasing teachers' sense of frustration that they were not accomplishing what they had intended, this would also build in more opportunities to create and practice using student assessments that would document multiple learning outcomes. Few of the teachers felt confident about how to evaluate student learning that resulted from problem-based activities. Coupled with a more systematic teacher inquiry approach, regularly examining teacher- and student-learning would become more integrated into their work.

References

Bailey, T. (1997). *Integrating academic and industry skill standards*. Berkeley: University of California, National Center for Research in Vocational Education.

Carl D. Perkins Vocational-Technical Education Act Amendments of 1998 (P.L. 105-332). Retrieved January 25, 2002 from http://www.ed.gov/offices/OVAE/VocEd/InfoBoard/legis.html

Eisenman, L. (2000). Characteristics and effects of integrated academic and occupational curricula for students with disabilities: A literature review. *Career Development for Exceptional Individuals, 23*, 105-119.

Finch, C. (1999, February). Using professional development to meet teachers' changing needs: What we have learned. *Centerpoint* (2), 1-14. Berkeley: University of California, National Center for Research in Vocational Education.

Grubb, N., Davis, G., Lum, J., Plihal, J., & Morgaine, C. (1991). *"The cunning hand, the cultured mind": Models for integrating vocational and academic education*. Berkeley: University of California, National Center for Research in Vocational Education.

Hawley, W., & Valli, L. (1999). The essentials of effective professional development: A new consensus. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the Learning Profession* (pp. 127-150). San Francisco: Jossey-Bass.

Hughes, K., Bailey, T., & Mechur, M. (2001). *School-to-work: Making a difference in education*. New York: Teachers College, Columbia University, Institute on Education and the Economy.

Lincoln, Y., & Guba, E. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage.

Little, J. (1993). Teachers' professional development in a climate of educational reform. *Educational Evaluation and Policy Analysis, 15*, 129-151.

Mills, G. (2000). *Action research: A guide for the teacher researcher*. Upper Saddle River, NJ: Merrill, Prentice-Hall.

Oakes, J., Selvin, M., Karoly, L., & Guiton, G. (1992). *Educational matchmaking: Academic and vocational tracking in comprehensive high schools*. Berkeley: University of California, National Center for Research in Vocational Education.

*QSR NUD*IST 4.* (1997). Thousand Oaks, CA: Scolari, Sage Publications Software.

Ramsey, K., Stasz, C., Ormseth, T., Eden, R., & Co, J. (1997). *Designing classrooms that work: Teacher training guide.* Berkeley: University of California, National Center for Research in Vocational Education

Resnick, L., & Wirt, J. (1996). *Linking school and work*. San Francisco: Jossey-Bass.

School-to-Work Opportunities Act of 1994, 20 U.S.C. § 6101 *et seq.* (Capitol Publishing, 1994).

Schmuck, R. (1997). *Practical action research for change*. Arlington Heights, IL: IRI/Skylight.

Stake, R. (1995). *The Art of Case Study Research*. Thousand Oaks, CA: Sage.

Stasz, C. (1997). *Designing classrooms that work: Conception and pilot study*. Berkeley: University of California, National Center for Research in Vocational Education.

Stasz, C., Kaganoff, T., & Eden, R. (1994). Integrating academic and vocational education: A review of the literature, 1987-1992. *Journal of Vocational Education Research,19*, 25-77.

Stern, D., Finkelstein, N., Stone, J., Latting, J., & Dornsife, C. (1994). *Research on school-to-work transition programs in the United States.* Berkeley: University of California, National Center for Research in Vocational Education.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research.* Newbury Park: Sage.

U.S. Department of Labor. (1991). *Skills and tasks for jobs: A SCANS report for America 2000*. Washington, DC: author, The Secretary's Commission on Achieving Necessary Skills.

The Authors

Laura Eisenman is Associate Professor in the School of Education, 213H WHL, University of Delaware, Newark, DE 19716. e-mail: eisenman@udel.edu.

Douglas Hill is Director of the Office for School-To-Work at the University of Delaware, Rextrew Bld., 321 South College Ave., Newark, DE 19716. e-mail: dhill@udel.edu

Rodney Bailey is School-to-Careers Program Administrator for the Red Clay Consolidated School District, 2916 Duncan Road, Wilmington, DE 19808. e-mail: Rodney.Bailey@redclay.k12.de.us

Carrie Dickison received her M.Ed. in School Counseling at the University of Delaware and is a high school counselor in Massachusetts.